



The UK Injectable Medicines Guide

Adopted for use in NHS Lothian

Produced by
NHS Lothian Medicines Information Service (July 2013)
Pharmacy Department
Royal Infirmary of Edinburgh
E-mail: medicines.information@luht.scot.nhs.uk
Telephone: 0131 242 2920

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A

Acetazolamide
Acetylcysteine
Aciclovir powder
Aciclovir solution
Aclasta (See zoledronic acid)
Adrenaline
Albumin 5%
Albumin Concentrate
Alfentanil
Alteplase
Amikacin
Aminophylline
Amiodarone
Amoxicillin
Amphotericin - AmBisome
Amphotericin – Fungizone
Anidulafungin
Artensunate
Aztreonam

B

Beriplex (see Dried prothrombin complex)
Benzylpenicillin
Bumetanide

C

Calcium folinate
Calcium gluconate
Caspofungin
Cefotaxime
Ceftazidime
Ceftriaxone
Cefuroxime
Chloramphenicol
Chlorphenamine

Ciprofloxacin
Clarithromycin
Clindamycin
Clonazepam
Co-amoxiclav
Colistimethate Sodium (Colomycin or Colistin)
Cosmofer
Co-trimoxazole
Cyclizine

D

Daptomycin
Dexamethasone
Diamorphine
Diazepam
Diazepam (Diazemuls)
Diclofenac
Digifab
Digoxin
Disodium pamidronate powder for solution
Disodium pamidronate solution
Dobutamine
Dopamine
Doxapram
Dried prothrombin complex

E

Ephedrine
Epilium (See sodium valproate)
Episenta (See sodium valproate)
Ertapenem
Erythromycin
Esomeprazole

F

Fentanyl
Ferric carboxymaltose (See Ferrinject)
Ferrinject
Flebogamma Dif 50mg/ml
Flebogamma Dif 100mg/ml
Flecainide
Flucloxacillin
Fluconazole
Flucytosine
Flumazenil
Fosfomycin

Furosemide

G

Ganciclovir

Gelatin

Gentamicin

Glyceryl trinitrate

Granisetron

H

Haem arginate

Haloperidol

Heparin sodium

Hydralazine

Hydrocortisone sodium phosphate

Hydrocortisone sodium succinate

I

Imipenem

Insulin (soluble)

Iron dextran (See Cosmofer)

Iron Isomaltose (See Monofer)

Iron sucrose (See Venofer)

Isoniazid

Isoprenaline

K

Ketorolac

Kiovig

Konakion MM (See phytomenadione)

L

Labetalol

Lepirudin

Levetiracetam

Levofloxacin

Levomepromazine

Linezolid

Liothyronine

Lorazepam

M

Magnesium sulphate

Meropenem

Mesna

Methylprednisolone

Methylthioninium chloride
Metoclopramide
Metronidazole
Midazolam
Milrinone
Monofer
Morphine sulphate
Mycophenolate mofetil

N

Naloxone
Nitrocline (See glyceryl trinitrate)
Noradrenaline

O

Octagam 5%
Octagam 10%
Octreotide
Ondansetron
Oxycodone

P

Pabrinex
Pamidronate disodium (see disodium pamidronate)
Pancuronium
Pantoprazole
Paracetamol
Pethidine
Phenylephrine
Phenytoin
Phosphate Polyfuser
Phytomenadione (Konakion MM)
Piperacillin/tazobactam
Potassium chloride
Procyclidine
Propofol
Protamine sulphate

Q

Quinine

R

Ranitidine
Rasburicase
Rifampicin

S

Sodium fusidate
Sodium nitroprusside
Sodium stibogluconate
Sodium valproate (Epilium)
Sodium valproate (Episenta)
Sugammadex
Synacthen

T

Tacrolimus
Teicoplanin
Tenecteplase
Terlipressin powder
Terlipressin
Tobramycin
Tramadol
Tranexamic acid

V

Vancomycin
Venofer
Voriconazole

Z

Zidovudine
Zolendronic acid (Aclasta)
Zolendronic acid (Zometa)

NHS Lothian Pharmacy Services

Injectable Medicines Summary Table for Routes of Administration

Following is a list of injectable medicines and their method of intravenous administration. Use this information in conjunction with the UK Injectable Medicines Guide (**red manual**).

- The option shaded in **blue** is the preferred method of intravenous administration for this medicine.
- When infusions can be given refer to the **red manual** for rates of infusion or administration time.
- Refer to the **red manual** when a medicine is ticked with more than one option and is shaded in **green**.
- If a medicine is not on the list then consult the manufacturers' information, or contact your clinical pharmacist for advice.

INFUSION PUMP TO USE ACCORDING TO THERAPY CATEGORY:

Infusion pumps should be used for all medicines to be given as an IV infusion, with the exception of some Therapy Category C. The following information is taken from the Medical Devices Agency Device Bulletin: 'Infusion systems MDA DB2003(02) v2.0 Nov 2010'

Infusion pumps are designed for a variety of clinical applications and their performance characteristics vary. The same level of technical performance of infusion pumps is not necessary for every clinical therapy. There are three therapy categories (A, B and C) and they determine the performance and safety parameters of the infusion pump required to deliver a particular medicine.

Therapy categories and critical performance parameters for an infusion pump

Therapy Category	Therapy description	Patient group	Critical performance parameters for infusion pump
A	Medicines with narrow therapeutic margin	Any patient	Good long term accuracy Good short term accuracy Rapid alarm after occlusion Small occlusion bolus Able to detect very small air embolus (volumetric pumps only) Small flow rate increments Good bolus accuracy Rapid start-up time (syringe pumps only)
	Medicines with short half-life ¹	Any patient	
	Any infusion given to neonates	Neonates	
B	Medicines, other than those with a short half-life ¹	Any patient except neonates	Good long-term accuracy Alarm after occlusion Small occlusion bolus Able to detect small air embolus (volumetric pumps only) Small flow rate increments Bolus accuracy
	Parenteral nutrition Fluid maintenance Transfusions	All volume sensitive patients except neonates	
	Diamorphine ²	Any patient except neonates	
C³	Parenteral nutrition Fluid maintenance Transfusions	Any patient except volume sensitive patients or neonates	Long-term accuracy Alarm after occlusion Small occlusion bolus Able to detect air embolus (volumetric pumps only) Incremental flow rates

Notes on Table

- 1) The half-life of a medicine cannot usually be specified precisely, and may vary from patient to patient. As a rough guide, medicines with half-lives of five minutes or less might be regarded as 'short' half-life drugs.
- 2) Diamorphine is a special case. The injected agent (diamorphine) has a short half-life, whilst the active agent (the metabolite) has a very long half-life. It is safe to use a device with performance specifications appropriate to the half-life of the metabolite.
- 3) Not all infusions require an infusion pump. Some category C infusions can appropriately be given by gravity.

Injectable Medicines Summary Table for Routes of Administration

Medicine	Bolus	Infusion, pump device	Infusion Therapy Category in Adults	Notes
Acetazolamide	✓			
Acetylcysteine		✓	B	
Aciclovir		✓	B	
Adrenaline	✓	✓	A	Depends on indication for use
Albunorm 5%		✓	B	
Albunorm concentrate		✓	B	
Alfentanil	✓	✓	A	Depends on concentration of preparation used
Alteplase	✓	✓	A	Depends on indication for use
Amikacin	✓	✓	A	
Aminophylline		✓	A	
Amiodarone		✓	B	
Amoxicillin	✓	✓	B	Depends on dose - up to 1g may be given via bolus
Amphotericin(Ambisome)		✓	B	
Amphotericin (Fungizone)		✓	B	
Anidulafungin		✓	B	
Artensunate	✓			
Aztreonam	✓	✓	B	
Beriplex	✓			
Benzylpenicillin	✓	✓	B	Depends on dose – up to 1.2g may be given via bolus.
Bumetanide	✓	✓	B	Depends on dose – up to 2mg may be given via bolus.
Calcium folinate	✓	✓	B	
Calcium gluconate	✓	✓	B	Bolus only in Emergency situation. In this case ECG monitoring advised
Caspofungin		✓	B	
Cefotaxime	✓	✓	B	
Ceftazidime	✓	✓	B	

Medicine	Bolus	Infusion, pump device	Infusion Therapy Category in Adults	Notes
Ceftriaxone	✓	✓	B	Depends on dose – up to 1g may be given via bolus
Cefuroxime	✓	✓	B	
Chloramphenicol	✓	✓	B	
Chlorphenamine	✓			
Ciprofloxacin		✓	B	
Clarithromycin		✓	B	
Clindamycin		✓	B	Maximum of 1.2g for intermittent infusion. Doses greater than 1.2g must be given as a continuous infusion
Clonazepam	✓	✓	B	
Co-amoxiclav	✓	✓	B	
Colistimethate sodium (Colomycin)	✓	✓	B	Depends on the presence or absence of a TIVAD.
Cosmofer	✓	✓	B	Depends on use, dosing schedule and patient group
Co-trimoxazole		✓	B	
Cyclizine	✓			
Daptomycin	✓	✓	B	
Dexamethasone	✓	✓	B	
Diamorphine	✓	✓	B	Depends on use
Diazepam	✓	✓	B	
Diazepam (Diazemuls)	✓	✓	B	Depends on use
Diclofenac		✓	B	
Digifab	✓	✓	B	IV Bolus should ONLY be used if cardiac arrest is imminent
Digoxin		✓	A	
Disodium pamidronate		✓	B	
Dobutamine		✓	A	
Dopamine		✓	A	
Doxapram	✓	✓	B	Depends on use
Ephedrine	✓			
Ertapenem		✓	B	

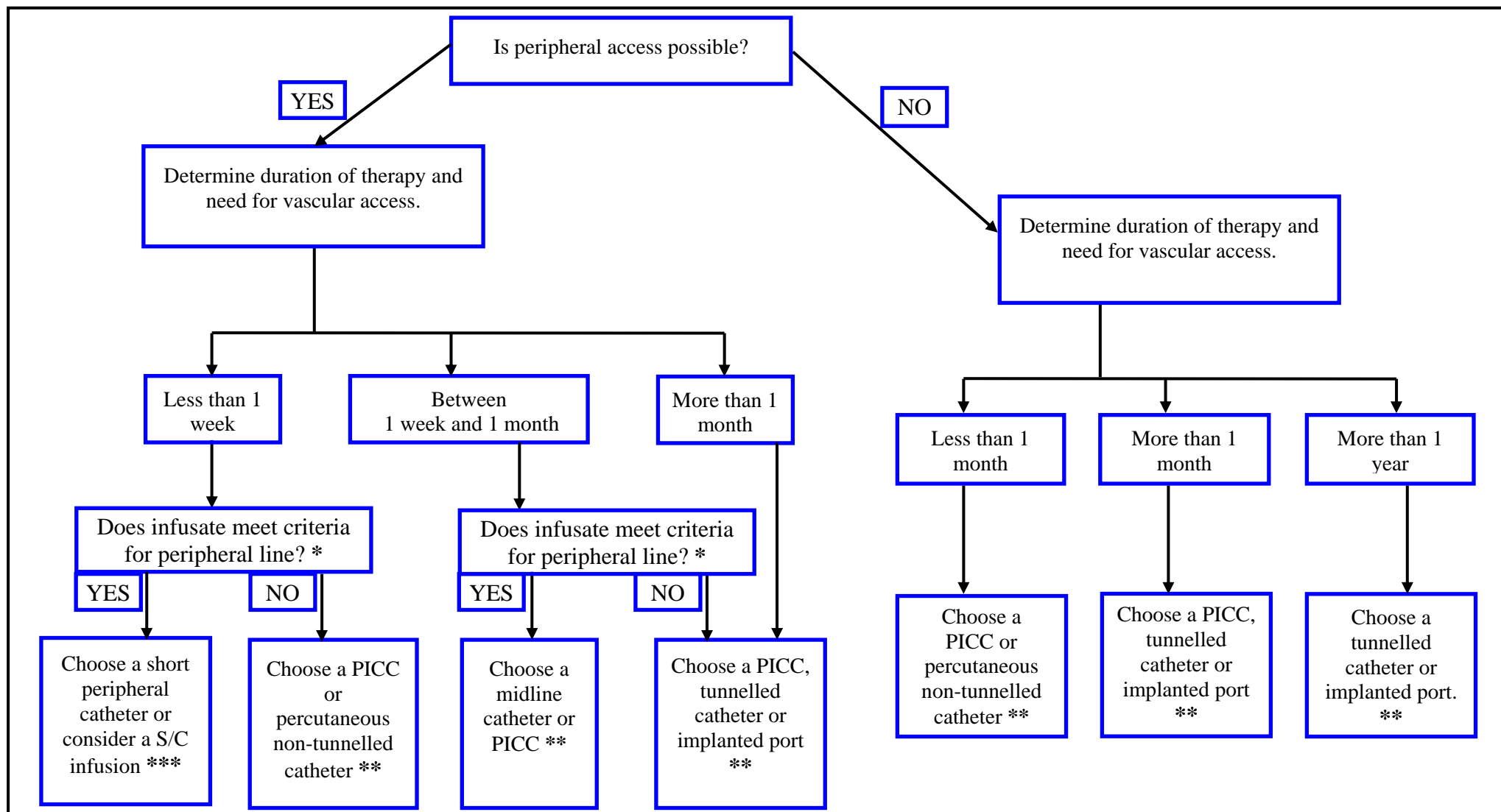
Medicine	Bolus	Infusion, pump device	Infusion Therapy Category in Adults	Notes
Erythromycin		✓	B	
Esomeprazole	✓	✓	B	Depends on use
Fentanyl	✓	✓	B	Depends on use
Ferrinject	✓	✓	B	Depends on dose
Flebbogamma Dif		✓	B	
Flecainide	✓	✓	B	IV bolus for initial treatment dose only
Flucloxacillin	✓	✓	B	Depends on dose - Maximum of 1g can be given via bolus
Fluconazole		✓	B	
Flucytosine		✓	B	
Flumazenil	✓	✓	B	Depends on use
Fosfomycin		✓	B	
Furosemide	✓	✓	B	Depends on dose
Ganciclovir		✓	B	
Gentamicin	✓	✓	A	Depends on use and dosing schedule
Glyceryl trinitrate		✓	A	
Granisetron	✓	✓	B	
Haloperidol	✓	✓	B	Depends on use
Heparin sodium	✓	✓	A	Depends on use - loading dose ONLY can be given via bolus
Hydralazine	✓	✓	B	Depends on use
Hydrocortisone sod phos	✓	✓	B	
Hydrocortisone sod succ	✓	✓	B	
Imipenem		✓	B	
Insulin soluble	✓	✓	A	Depends on use
Isoniazid	✓			
Isoprenaline	✓	✓	A	Depends on concentration and use
Ketorolac	✓			
Kiovig		✓	B	
Labetalol	✓	✓	B	Depends on dose and concentration
Lepirudin	✓	✓	A	Depends on use - loading dose ONLY can be given via bolus

Medicine	Bolus	Infusion, pump device	Infusion Therapy Category in Adults	Notes
Levetiracetam		✓	B	
Levofloxacin		✓	B	
Levomepromazine	✓			
Linezolid		✓	B	
Lorazepam	✓			
Magnesium sulphate	✓	✓	B	Depends on dose and use
Meropenem	✓	✓	B	
Mesna		✓	B	
Methylpredisolone	✓	✓	B	Doses above 250mg should be given via infusion
Methylthioninium chloride		✓	A	
Metoclopramide	✓	✓	B	Depends upon concentration and dose - Doses above 10mg should be given via infusion
Metronidazole		✓	B	
Midazolam	✓	✓	B	Depends on use
Milrinone		✓	B	
Monofer	✓	✓	B	Depends on dose
Morphine sulphate	✓	✓	B	Depends on dose and use
Mycophenolate mofetil		✓	B	
Naloxone	✓	✓	B	Depends on use
Noradrenaline		✓	A	
Octagam		✓	B	
Octreotide	✓			
Ondansetron	✓	✓	B	Depends on use
Oxycodone	✓	✓	B	Depends on use and dose given. Doses above 10mg cannot be given via bolus injection.
Pabrinex	✓	✓	B	
Pancuronium	✓			
Pantoprazole	✓	✓	B	
Paracetamol		✓	B	

Medicine	Bolus	Infusion, pump device	Infusion Therapy Category in Adults	Notes
Pethidine	✓	✓	B	Depends on use
Phenylephrine	✓	✓	A	Depends on use and concentration
Phenytoin	✓	✓	A	
Phosphate Polyfuser		✓	A	
Phytomenadione (Vitamin K)	✓	✓	B	
Piperacillin/tazobactam		✓	B	Change in licensing by manufacturer – no longer licensed to be given via IV Bolus.
Potassium chloride		✓	A	
Procyclidine	✓			
Propofol	✓	✓	A	Depends on use
Protamine sulphate	✓	✓	A	
Ranitidine	✓	✓	B	
Rasburicase		✓	B	
Rifampicin		✓	B	
Sodium fusidate		✓	A	
Sodium nitroprusside		✓	A	
Sodium stilboglucuronate	✓	✓	B	
Sodium valproate (Epilium)	✓	✓	B	
Sodium Valproate (Episenta)	✓	✓	B	
Tacrolimus		✓	A	
Teicoplanin	✓	✓	B	
Tenecteplase	✓			
Terlipressin	✓			
Tobramycin	✓	✓	B	
Tramadol	✓	✓	B	
Tranexamic acid	✓	✓	B	Depends on use

Medicine	Bolus	Infusion, pump device	Infusion Therapy Category in Adults	Notes
Vancomycin		✓	A	
Venofer	✓	✓	B	Depends on use
Voriconazole		✓	B	
Zidovudine		✓	A	
Zolendronic acid (Aclasta)		✓	B	
Zolendronic acid (Zometa)		✓	B	

Selecting an appropriate vascular access device for administration of intravenous fluids and medication



* Infusate criteria for use in peripheral infusions:

- Should be administered at a concentration and rate appropriate for peripheral administration.
- Osmolarity should be 600mOsm/L or less.
- pH should be between 5 and 9.
- **Should not be a vasoconstrictor.**
- Medication should not be a vesicant or irritant.

** Catheter lumens:

- Consider the need for single or multi-lumen catheter to deliver the prescribed therapy.
- Select the least number of lumens to deliver the required therapy.

*** Considerations for subcutaneous infusion (S/C) include:

- Hydration, intermittent infusions, and continuous infusions of isotonic fluids and a few selected medications.
- **S/C route is not appropriate for administration of fluids in an emergency**
- Patient assessed appropriately for this mode of therapy.

Headings used in the Injectable Medicines Guide monographs for intravenous medicines

Intravenous

Generic Name of Drug

GENERIC MEDICINE NAME:

TRADE NAME(S):

®

PRESENTATION OF MEDICINE:

METHOD OF ADMINISTRATION:

- All medicines can be administered via the central route. For some medicines this is the preferred or essential route, for example, vasoconstrictor medicines (e.g. adrenaline and noradrenaline).
- Medicines of extreme pH (<5 or >9) or osmolarity (>600mOsmol/L) should preferably be administered centrally rather than peripherally due to their potential to cause vein injury (RCN 2010 Standards for Infusion Therapy)
- Central venous administration provides rapid dilution and distribution of the medicine, avoiding local toxicity to the vein wall.
- The concentration and rate of administration of a medicine administered centrally is important. Central administration via a neck vein delivers medication close to the heart where some may have a toxic effect. For example, potassium and calcium must be administered slowly when given via the central route to allow for dilution within the circulation, as high concentrations can be toxic to the heart causing asystole.

Advice on selecting an appropriate vascular access device for administration of intravenous fluids and medication can be found in the following flow chart which has been adapted from BJN 2010, Vol 19, No 2 Central venous access devices Part 1: Devices for acute care (see page [Insert Page number]).

INSTRUCTIONS FOR RECONSTITUTION:

Some medicines are presented as dry powders and must be reconstituted before use. The volume of diluent required for reconstitution and the recommended diluent to use is described.

DISPLACEMENT VALUE:

Where reconstitution is necessary and the dose of the medicine required is less than a complete vial it may be necessary to calculate the displacement value of the medicine. Displacement values are usually only applicable to paediatrics.

e.g. To give a dose of 125mg amoxicillin from a 250mg vial
The displacement value of amoxicillin 250mg is 0.2mL
If 4.8ml of diluent is added to a 250mg vial, the volume of the resulting solution is 5mL (i.e. 4.8mL plus 0.2mL)
Therefore 125mg will be contained in 2.5mL of the solution.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Many medicines require further dilution before they can be given by injection or infusion. This section indicates if the medicine can be diluted in sodium chloride 0.9% or glucose 5% (the most common diluents) before use. Information on other suitable diluents (infusion fluids) can be found in the 'compatibility information useful in clinical practice' section of the monograph.

Details of the volume of diluent to be used are given where this is important.

When preparing a medication for administration, do not combine vials/ampoules from more than one manufacturer to make up the total dose.

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL or STABILITY

Unless otherwise stated in the monograph, infusions should be given an expiry time of 24 hours if prepared in a clinical area. Be aware that local policies may differ.

N.B. The use of a different diluent or concentration to that recommended in the 'instructions for dilution and suitable diluent' section may affect the stability of the solution and reduce the expiry time.

Administration of a dose prepared in a clinical area should be started immediately (exceptions; see NPSA Patient Safety Alert 20: Promoting safer use of injectable medicines. March 2007).

EXAMPLE CALCULATION:

In a number of monographs, example calculations are given.

- The information provided does not replace the need to accurately calculate the correct infusion rate for a particular patient and the example calculation should only be used to check that the infusion rate calculated for a specific patient is in the correct range. Doses given in this section are just an example, and should not be used as a reference for prescribing or checking the prescription.
- For adult patients if a calculated infusion rate gives a figure to two decimal places, round to one decimal place when setting the infusion pump e.g. 5.24mL/hour (and below) is rounded down to 5.2mL/hour and 5.25mL/hour (and above) is rounded up to 5.3mL/hour.
- Always check that the units in the example calculation match those that are used in your Trust.

FLUSHING:

- Sodium chloride 0.9% is recommended as a flush for most drugs. In a very few circumstances sodium chloride 0.9% should not be used and glucose 5% is recommended as an alternative.
- Water for injections should not be used as a flush because water haemolyses red blood cells (leading to hyperkalaemia).
- Do not flush at a rate which exceeds the rate of administration of the IV injection or infusion to be flushed.
- For some infusions, e.g. those containing a vasoactive medicine (e.g. inotropes, antihypertensive agents, vasodilators, anti-arrhythmic agents), the central venous access device should not be flushed when the infusion is discontinued. For these preparations, when the infusion is discontinued, disconnect the giving set, aspirate the cannula contents and discard it, then flush with sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

This section includes details of adverse effects that may occur acutely, either during or very shortly after, administration of a medicine by the intravenous route and suggested appropriate monitoring.

Use this information carefully as it is not intended to be an exhaustive list of all possible adverse effects resulting from administration of the medicine, or all required monitoring.

A full list of possible adverse effects can be found in the medicine's 'Summary of Product Characteristics' (SPC) available as a 'link' in the 'Current Suppliers' section of the monograph.

Be aware that the monitoring suggested may not be possible in all clinical areas.

EXTRAVASATION:

Extravasation is the inadvertent administration of a vesicant or irritant into the tissues. Administration of a non-irritant or non-vesicant solution into the tissues is classified as infiltration.

The following have the potential to cause tissue injury if extravasation occurs and should, if possible, be administered via a central venous access device:-

- medicines that have an extreme pH (less than 5 and greater than 9)
- medicines with high osmolarity (greater than 600mOsmol/L)
- cytotoxic medicines
- calcium preparations
- glucose preparations $\geq 20\%$
- medicines liable to precipitate e.g. diazepam
- vasoconstrictors e.g. noradrenaline and adrenaline
- preparations which contain alcohol, polyethylene glycol and certain other injection excipients.

The 'National Extravasation Information Service' provides information on factors which may result in tissue damage if a medicine is accidentally extravasated and suggested treatment. It can be accessed via the 'documents and links' page of the website.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatibility charts in common use can be found on the 'documents and links' page of the website.

General principles:

- 1) It should **NEVER** be necessary to administer an IV injection via a running infusion that also contains a medicine additive. Any infusion containing a medicine should be stopped temporarily and the line should be flushed both before and after the injection is given. If an IV injection is administered via a line which is being used to administer a compatible crystalloid, this can be used as the flushing solution.
- 2) Infusions containing a medicine should ideally always be infused separately. If it is necessary to administer two infusions via the same vascular access device mixing should occur as close to the vascular access device as possible.
- 3) A medicine should not be added to any infusion which already contains a medicine additive unless the addition is one of a very few exceptions which are identified in the appropriate monographs.
- 4) All medicine mixtures should be checked for signs of incompatibility, for example

cloudiness, change in colour, haze or formation of precipitate.

- 5) The cannula insertion site should be regularly checked for signs of local inflammation. Chemical phlebitis may be attributable to a medicine incompatibility.
- 6) Additions should never be made to the following infusions and these infusions should always be infused separately
 - Parenteral nutrition solutions (except glutamine)
 - Sodium bicarbonate infusions
 - Phosphate preparations
 - Blood components
 - Plasma substitutes e.g. artificial volume expanders such as starches and gelatins
- 7) Try to avoid infusing a medicine which is being administered at a very low infusion rate in conjunction with another infusion containing a medicine additive because the 'dead-space' volume of the vascular access device may result in prolonged contact of the two medicines.
- 8) If it is necessary to infuse **more than** two medicines via the same delivery route ensure that all medicines are compatible with each other and with the diluents used.
- 9) It is good practice to infuse inotropes and vasopressors via a dedicated infusion lumen of a central venous access device. Different inotropes & vasopressors may be infused in combination via the same lumen provided they are compatible.

The following summarises specific points to be considered when interpreting the compatibility information provided:-

- 1) The information is provided as a guide only and is not exhaustive.
- 2) Published compatibility information is usually based on specific medicine infusion concentrations and requires careful interpretation if different concentrations are used.
- 3) Compatibility information supplied is relevant to the usual infusion concentrations recommended for use in this website but may not apply to other concentrations. Check with a pharmacist if different concentrations are used.
- 4) Medicine compatibility information is mainly based on physical compatibility i.e. there are no visible sign of incompatibility.
- 5) **When stated as compatible in the Injectable Medicines Guide it is assumed that medicines meet close to the vascular access device and not in an infusion bag, burette or syringe.**
- 6) When using the compatibility information, check that the medicines are compatible with the infusion fluids in use. For example if dopamine in sodium chloride 0.9% is to be infused through a line containing dobutamine in glucose 5%, check that both dopamine and dobutamine are compatible with both sodium chloride 0.9% and glucose 5%.
- 7) pH values have been included in the Injectable Medicines Guide. Medicines with widely differing pH values are usually incompatible.

SODIUM CONTENT (mmol):

The sodium content stated is of the product as it is supplied by the manufacturer. It is stated in mmol throughout. The sodium content will alter if sodium chloride 0.9% is used to reconstitute or dilute the medicine.

OSMOLARITY / OSMOLALITY:

- 1) The majority of intravenous medicines are formulated to have an osmotic pressure similar to that of plasma. This minimises disturbance to the tissues when administered.
- 2) Infiltration into tissues of solutions with an osmolality greater than that of plasma (>290

mOsmol/l) may cause tissue damage. It is recommended that if the osmolality is greater than 600mOsmol/L the medicine should be infused via a central venous access device, unless there is a clinical emergency in which case a large peripheral vein can be used.

- 3) The following is a selection of medicines that have high osmolality and may potentially cause a problem if extravasated.

Calcium gluconate 10%	670mOsmol/L
Calcium chloride 5mmol/10ml	1,500mOsmol/L
Glucose 20%	1,110mOsmol/L
Glucose 50%	2,775mOsmol/L
Magnesium sulphate 10%	933mOsmol/L
Mannitol 20%	1,100mOsmol/L
Parenteral nutrition bags	(variable with bag contents)
Potassium chloride 20mmol/10ml	4,000mOsmol/L
Sodium bicarbonate 4.2%	1,004mOsmol/L
Sodium bicarbonate 8.4%	2,008mOsmol/L
Sodium chloride hypertonic solutions (concentrations exceeding 1.8%)	
X-ray contrast media	

pH:

Medicines with a high (greater than 9) or low (less than 5) pH (e.g. aciclovir, amphotericin, ganciclovir, methylthioninium chloride, phenytoin, phenobarbital) are likely to cause tissue damage if extravasation occurs. It is recommended that these products are administered via a central venous access device unless in a clinical emergency in which case a large peripheral vein can be used. The pH stated is usually that of the undiluted reconstituted medicine but in most circumstances dilution does not significantly alter the pH.

OTHER COMMENTS:

This section:

- States if a product requires protection from light whilst it is being administered.
- Gives details of any required pre-medication.
- Highlights any SPC changes or a significant NPSA/MHRA alert which has become available since a monograph was last published.

OTHER INJECTABLE ROUTES OF ADMINISTRATION:

This section is only accessible using a pharmacy password. It includes injectable routes, other than IV (both licensed and, if known, unlicensed) which may be used.

REFERENCES:

Standard resources are used to prepare IV monographs.

Version number

Good practice for the prescribing of injections

1. The injection route is more hazardous than other routes of administration of medicines.
2. Prescribe medicines by injection only if no other route is suitable. For example:
 - the medicine is not available for administration by another route, and there is no therapeutically equivalent medicine that could be used by another route, or
 - the oral, naso-gastric, rectal or other possible route is not suitable due to the clinical condition of the patient, or
 - the medicine needs to be administered by injection to achieve immediate effect, or the required therapeutic level
3. If an injection needs to be prescribed, write a specific finishing date on the prescription, or else review it every 24 hours and change to a less hazardous route at the earliest opportunity.
4. For antibiotics, consider changing from IV to oral when the patient fulfils the following criteria:
 - temperature below 38 degrees C for 48 hours, and
 - patient clinically improved and there are no longer clinical indications for IV therapy, and
 - oral fluids/food are tolerated and there is no reason to believe that oral absorption of antibiotics may be poor, and
 - there is a suitable oral alternative available
5. Prescribe injections by bolus wherever possible, and only add to infusions in the following circumstances:
 - constant plasma concentrations are needed, or
 - immediate control of plasma concentrations is needed, or
 - a minimum administration time is required, or
 - a more concentrated solution would be harmful, or
 - the volume required for bolus, due to the dose required, is excessive

Good practice for the preparation of injections

1. Hazards associated with the preparation of injections include:

- incorrect dosage calculation
- selection of wrong medicine or diluent
- incorrect method of preparation
- incompatibility of constituents
- instability of final product
- microbial contamination
- particulate contamination
- health and safety risk to the operator or the environment

2. Training and competency

Only nurses who have successfully completed the Division intravenous therapy training programme or equivalent may prepare and administer intravenous injections. Assessment of competence must be repeated every 3 years.

3. How to use this manual

The information in this manual should be used to assist in the preparation of medicines that need to be diluted and/or reconstituted before administration.

Before using these monographs, the information included in the reference monograph overleaf must be read and clearly understood. All the medicines included in the manual may be administered by nursing staff who have successfully completed the IV drug administration programme. Other medicines may be administered by nursing staff providing they have sufficient information available to allow for safe preparation and administration.

The information required will include:

- strength of preparation available
- method of reconstitution if applicable
- suitable diluent and volume of diluent
- compatible IV fluids
- concentration and volume of final solution
- stability of prepared solution
- route of administration
- rate of administration

This information should be taken from an approved reference source, eg. manufacturers package insert, BNF, Ward protocols which have been approved by Pharmacy or ABPI Summary of Product Characteristics.

If in doubt please contact your clinical pharmacist or medicines information service. At RIE and WGH please call 22920; at SJH please call 52035; and for REAS please call 46421.

4. Procedure for the preparation of injections

- Check first that the injection you require is not already available in a ready-to-use form.
- Only prepare injections for one patient at a time, and administer them before starting preparation for another patient.
- Follow the procedure shown on the “Preparation of injections in patient areas” chart attached.

5. Labelling

- Injections must be clearly identifiable at all stages during preparation and administration.
- Prepare the label before starting preparation of the injection so that it may be affixed immediately after preparation is complete.
- If the injection is to be given by bolus, and will be supervised at all times during preparation and completion of administration, write the name of the medicine on a sticker and use it to label the final container (the syringe, bag etc). Keep the finished preparation and original containers in an individual tray between preparation and administration.
- If the injection is not to be given by bolus, or is unsupervised at any time between preparation and completion of administration, label the container (the syringe, bag etc), using the standard approved label shown below.

Affix patient addressograph or complete		
Patient's name		
DOB		
Hospital number		
Ward & hospital		
Medicine name	Dose	Concentration
1.		
2.		
3.		
Diluent		Volume ml
Date & time (24h clock) prepared		
Date & time (24h clock) expires		
Prepared by		Checked by

- For syringe drivers, affix the label to a flag to avoid obliterating the graduations on the syringe, and to allow inspection of the solution. Do not use the flag more than once – always use a new flag when preparing a new syringe.
- Label syringes containing solutions to be used as flushes with a pre-printed label to avoid the risk of selection error.
- The poster supplied to ward areas at the time of the change can be seen over.

New labelling system for medicines prepared for injection

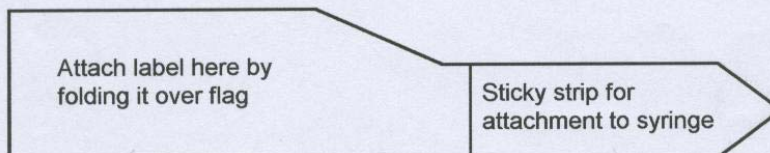
A new labelling system has been developed to improve the clarity of labels applied to medicines for injection that are prepared in all treatment areas including wards. Every time an injection is prepared (i.e. mixed, diluted or reconstituted) and not administered instantly, it must be identified with a label.

The same adhesive label (see below) will be used for medicines in syringes and infusion bags, including those that are administered via infusion pumps. The new label can utilise the standard patient addressograph identification sticker as part of the information.

To label an infusion bag, enter the details on the label then attach it directly to the bag.

To label a syringe, enter the details on the label then attach it to a clear plastic film 'flag' by folding it over the wide end of the flag. Attach the flag to the syringe by its sticky narrow end. The label can then lie outside an infusion pump and can be read easily, rather like a luggage tag. The previous system of attaching the label to the syringe meant that most of the information on the label could not be read whilst the syringe was in the pump and the scale on the plunger was obscured. This new system permits the syringe scale to be clearly visible at all times whilst the attached flag carries all the necessary information to identify the patient and the syringe contents.

The flag



The new label

Affix patient addressograph or complete

Patient's name **NHS**

DOB **Lothian**

Hospital number **University Hospitals**

Ward & hospital **Division**

Medicine name	Dose	Concentration
1.		
2.		
3.		
Diluent	Volume	ml
Date & time (24h clock) prepared		
Date & time (24h clock) expires		
Prepared by	Checked by	

The flag label in use in a syringe pump



Preparation of injections in patient areas

Step 1

- 1 It is generally recommended that intravenous medicines are prepared by two practitioners. Under exceptional circumstances when delay in administration may cause harm to the patient, preparation and administration should not be delayed by the absence of a second practitioner. Other local exceptions must be defined, documented and approved by the appropriate manager for the clinical area.
- 2 Check the formulation, dose and diluent against the prescription and the product information. Note that some formulations of medicines are similar e.g. plastic ampoules and nebulisers. Check the route of administration.
- 3 Prepare the label for the injection.
- 4 Ensure that the area in which the injection will be prepared is uncluttered, clean and quiet.
- 5 Wash hands.
- 6 Assemble the items required – medicine, syringe, needle, swabs, gloves, disposable tray, etc. Check expiry dates. Check the integrity of packaging and containers.
- 7 Put on a pair of disposable gloves if the injection is hazardous e.g. an antibiotic.
- 8 Use a 70% isopropyl alcohol swab to disinfect the surface on which the injection will be prepared.
- 9 Assemble syringe(s) and needle(s) - peel back wrappers - do not push through wrappers as this results in particulate contamination.
- 10 Use a 'no-touch' technique i.e. avoid touching areas where bacterial contamination may be introduced e.g. syringe tips, the surfaces of the plunger that go inside the syringe barrel, needles, vial tops, etc.
- 11 Prepare the injection according to the appropriate section in Step 2.

Step 3

- 12 Label the container. Labelling of a syringe is required only when more than one is being prepared or when it is not for immediate administration.
- 13 Place the container of medicine in a tray for transport to the patient.

Step 2

Drawing liquid from an ampoule into a syringe

- 11.1 Swab the neck of the ampoule with an alcohol wipe and allow to dry for a minimum of 30 seconds.
- 11.2 Snap open the neck of the ampoule.
- 11.3 Draw the required volume into the syringe. Tilt the ampoule if necessary to allow the required volume to be withdrawn.
- 11.4 Tap the syringe lightly to concentrate the air bubbles. Expel the air.
- 11.5 Remove the needle from the syringe and fit either a new needle or a sterile blind hub.

Drawing liquid from a vial into a syringe

- 11.1 Remove the tamper-evident seal from the vial and swab the rubber cap with an alcohol wipe. Allow to dry for a minimum of 30 seconds.
- 11.2 With the needle cover on, draw the syringe plunger back to the desired volume.
- 11.3 Remove the needle cover and insert the needle into the rubber cap.
- 11.4 Invert the vial. Keep the needle in the liquid and gradually depress the plunger to push the air into the vial.
Note – if a large volume of liquid is to be withdrawn, use a 'push and pull' technique i.e. inject 5ml of air and withdraw 5ml liquid until the required volume is in the syringe. This technique minimises the risk of aerosol spray by avoiding a build-up of pressure in the vial.
- 11.5 Release the plunger so that the liquid enters the syringe.
- 11.6 Tap the syringe lightly to concentrate the air bubbles. Push the air into the vial.
- 11.7 Fill the syringe to the required volume of liquid, draw in a small volume of air then remove the needle from the rubber cap.
- 11.8 Expel the excess air, remove the needle from the syringe and fit either a new needle or a sterile blind hub.

Reconstituting a vial of medicine in powder form and drawing the liquid into a syringe

- 11.1 Swab the rubber cap of the vial and the neck of the ampoule with an alcohol wipe. Allow to dry for a minimum of 30 seconds.
- 11.2 Use the procedure specified above for drawing liquid from an ampoule to draw the required volume of diluent into a syringe.
- 11.3 Inject the diluent into the vial. Release the pressure on the plunger. The syringe will fill with the air that has been displaced by the liquid (unless the contents of the vial are supplied under vacuum in which case the vacuum will draw the liquid into the vial).
Note – if a large volume of liquid is to be added, use a 'push and pull' technique i.e. inject 5ml of liquid and withdraw 5ml air until all the liquid is in the vial. This technique minimises the risk of aerosol spray by avoiding a build-up of pressure in the vial.
- 11.4 With the syringe and needle still attached, shake the vial to dissolve the powder (unless otherwise indicated in the product information).
- 11.5 Follow steps 11.4 – 11.8 of the procedure specified above for drawing liquid from a vial into a syringe.

Adding a medicine to an infusion

- 11.1 Prepare the medicine in a syringe using one of the techniques described above.
- 11.2 Swab the rubber cap of the infusion container with an alcohol wipe. Allow to dry for a minimum of 30 seconds.
- 11.3 Inject the medicine into the infusion container. Mix well.

Diluting a medicine in a syringe for use in a pump or driver

- 11.1 Prepare the medicine in a syringe using one of the techniques described above.
- 11.2 Draw the diluent into the administration syringe that is to be used in the pump or driver. Draw in some air and remove the needle.
- 11.3 Stand the syringe upright. Insert the needle on the syringe containing the medicine into the tip of the administration syringe. Inject the medicine.
- 11.4 Fit a blind hub to the administration syringe and mix the contents.
- 11.5 Remove the blind hub. Tap the syringe lightly to concentrate the air bubbles. Expel the gas. Refit the blind hub.

Good practice for the administration of injections

1. Infusion charts

For infusions that are administered using a rate controlling infusion device, record instructions, details of preparation, and observations during administration on the Intravenous Infusion Chart.

2. A time limit is required between preparation and completion of administration of injections due to the possibility of microbial contamination and lack of stability of the prepared solution. In order to reduce the risk of microbial contamination the maximum recommended time is 24 hours. However, depending on the medicine, a shorter time may be required due to limited stability. Refer to the individual monographs in this manual or the manufacturer's product information for guidance on stability times.

If an injection requires to be administered over a period longer than 24 hours, a risk assessment must be undertaken, documented and approved by the appropriate manager for the clinical area.

Intravenous

Acetazolamide

MEDICINE NAME:

Acetazolamide

TRADE NAME(S):

Diamox®

PRESENTATION OF MEDICINE:

Vials containing acetazolamide 500mg powder for reconstitution (as sodium salt).⁽¹⁾⁽⁵⁾

METHOD OF ADMINISTRATION (adult):

IV injection: Give by slow IV injection over 3-5 minutes.

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a high pH.⁽¹⁰⁾ If a central venous access device is unavailable a risk benefit analysis should be made on an individual patient basis.⁽¹⁰⁾ If given peripherally, the insertion site must be monitored closely for phlebitis using a recognised infusion phlebitis scoring tool.⁽¹⁰⁾

INSTRUCTIONS FOR RECONSTITUTION (adult):

Reconstitute each vial with at least 5mL water for injections.⁽¹⁾ (10mL is recommended because of hypersomolarity).

DISPLACEMENT VALUE:

No information.⁽⁹⁾

STABILITY

Prepare immediately before administration.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

Acetazolamide is a sulphonamide derivative.⁽¹⁾ Hypersensitivity and other sulphonamide-related side effects may occur occasionally.⁽¹⁾⁽⁵⁾ Other adverse effects include paraesthesia, flushing, photosensitivity, flaccid paralysis and convulsions.⁽¹⁾⁽⁵⁾

Monitoring:

Ask patients to report any unusual skin rash.⁽⁵⁾ Monitor for symptoms of hypersensitivity, including airway, breathing or circulation problems, flushing, urticaria and angioedema.

Ask patients to report any pain, stinging, swelling or erythema at the injection site, which might indicate that extravasation has occurred.

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to the high pH.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion. Flush the line both before and after

giving the injection.

SODIUM CONTENT (mmol):

5mmol sodium per 500mg vial.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information available for reconstituted product from manufacturer.⁽⁹⁾

Theoretical osmolarity calculated using the molecular concentration method:⁽¹¹⁾

500mg reconstituted with 5mL water for injections to a concentration of 100mg/mL:

900mOsmol/L

500mg reconstituted with 10mL water for injections (as above) to a concentration of 50mg/mL:

450mOsmol/L

pH:

pH = 9 to 10 ⁽¹⁾⁽⁹⁾⁽¹²⁾

OTHER COMMENTS:

1. Do not store unreconstituted product above 25°C.⁽¹⁾
2. Monitor urea and electrolytes before and during treatment particularly in elderly patients and patients with diabetes, renal impairment, pulmonary obstruction or emphysema, who may be at risk of symptomatic metabolic acidosis with acetazolamide. Electrolyte imbalances may also occur.⁽¹⁾⁽²⁾⁽⁵⁾
3. Acetazolamide should not be used in patients hypersensitive to sulphonamides.⁽¹⁾

OTHER INJECTABLE ROUTES OF ADMINISTRATION:

IM injection: May be given by IM injection but the IV route is preferred due to the alkalinity of the solution making IM injection painful. ⁽¹⁾ Reconstitute with 5mL water for injections if giving by IM injection, to reduce injection volume.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Diamox® Sodium 500mg powder for solution for injection. Last revised September 2012
2. Martindale accessed via <http://www.medicinescomplete.com> on 31/12/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 31/12/2012
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 31/12/2012
5. British National Formulary, December 2012, accessed via www.medicinescomplete.com on 31/12/2012
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health, 2003 pg 2-3
a) British National Formulary for Children, December 2012, accessed via www.medicinescomplete.com on 31/12/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)

- a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
- 8. COSHH report compiled by manufacturer
- 9. Drug company name: Mercury Pharma. Date contacted: 31/12/2012 and 07/01/2013
- 10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
- 11. Langfield et al., 2010. Avoiding osmotic imbalances. British Journal of Clinical Pharmacy. 2, pp 307-308
- 12. QA Department, Charing Cross Hospital. Date contacted: 09/01/2013

Version 4

Intravenous

Acetylcysteine

MEDICINE NAME:

Acetylcysteine

TRADE NAME(S):

Parvolex®

Generic (Martindale (Aurum), Teva)

PRESENTATION OF MEDICINE:

Ampoules containing acetylcysteine 200mg/mL as concentrate for solution for infusion.

Ampoules containing acetylcysteine 2g in 10mL^(1a-c) or 4g in 20mL^(1c)

METHOD OF ADMINISTRATION:

Intravenous infusion:

For treatment of paracetamol poisoning 3 consecutive intravenous infusions administered as IV infusions as follows over 21 hour period (1):

- 1) 150mg/kg in 200ml of infusion fluid over **1 hour** then
- 2) 50mg/kg in 500ml of infusion fluid over **4 hours** then
- 3) 100mg/kg in 1 litre of infusion fluid over the next **16 hours**

See the product Summary of Characteristics for full dosing details at

www.emc.medicines.org.uk. The adult dosing table is extracted below:

Adult acetylcysteine prescription						
(each ampoule = 200 mg/mL acetylcysteine)						
Regimen	First Infusion		Second Infusion		Third Infusion	
Infusion fluid	200 mL glucose 5% or sodium chloride 0.9%		500 mL glucose 5% or sodium chloride 0.9%		1000 mL glucose 5% or sodium chloride 0.9%	
Duration of infusion	1 hour		4 hours		16 hours	
Drug dose	150 mg/kg acetylcysteine		50 mg/kg acetylcysteine		100 mg/kg acetylcysteine	
Patient Weight ¹	Ampoule volume ²	Infusion Rate	Ampoule volume ²	Infusion Rate	Ampoule volume ²	Infusion Rate
kg	mL	mL/h	mL	mL/h	mL	mL/h
40-49	34	234	12	128	23	64
50-59	42	242	14	129	28	64
60-69	49	249	17	129	33	65
70-79	57	257	19	130	38	65
80-89	64	264	22	131	43	65
90-99	72	272	24	131	48	66
100-109	79	279	27	132	53	66
≥110	83	283	28	132	55	66

¹ Dose calculations are based on the weight in the middle of each band. **If the patient weighs less than 40 kg use the paediatric dose table within Toxbase or the SPC available via the eMC link above.**

² Ampoule volume has been rounded up to the nearest whole number.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Glucose 5% is the preferred diluent as stated in administration guidelines above, however, sodium chloride 0.9% can be used as an alternative.^{(1a)(1c)(5)}

A colour change of the infusion solution to light purple has sometimes been noted and is not thought to indicate significant impairment of safety or efficacy.⁽¹⁾⁽⁵⁾

STABILITY:

Prepare immediately before administration.

FLUSHING:

No data available on file, but a suitable diluent may be used to flush the line. Glucose 5% would be the first choice followed by sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Anaphylactoid reactions have been reported. These include nausea/vomiting, injection site reactions, flushing, itching, rashes/urticaria, angioedema, bronchospasm/respiratory distress, hypotension; and rarely tachycardia or hypertension. These effects are usually manifest between 15- 60 minutes after beginning the infusion.^(1a-c)

Anaphylactoid reactions appear to be dose related. Infusions should be temporarily stopped, but can usually be restarted at a slower rate without further reaction.⁽²⁾

The manufacturer recommends that the infusion can normally be restarted at the lowest infusion rate of 100mg/kg in 1 litre over 16 hours. Signs of anaphylactoid reactions should be managed symptomatically as necessary.^{(1a-c)(2)(5)}

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Acetylcysteine is not compatible with rubber or metals, particularly iron, copper and nickel.^{(1a-c)(2)}

Silicone rubber and plastic are satisfactory for use with acetylcysteine.^(1a-c)

Some antibiotics including amphotericin, ampicillin sodium, erythromycin lactobionate, and some tetracyclines are either physically incompatible or may be inactivated on mixing with acetylcysteine.⁽²⁾

Acetylcysteine is compatible with the following infusions: potassium chloride 0.3% with sodium chloride 0.9%^{(1a)(1c)} and potassium chloride 0.3% with glucose 5%.^{(1a)(1c)}

SODIUM CONTENT (mmol):

Parvolex®: 14mmol per 10mL ampoule.^{(5)(9a)}

Teva 8.83mmol per 10mL ampoule.^(9b)

Aurum (Martindale): 0.03mmol per 10mL ampoule.^(9c)

pH:

pH = 6.0 to 7.5⁽⁴⁾ or 6.5 to 7.5.^(9b-c)

OTHER COMMENTS:

REFERENCES:

1. Summary of Product Characteristics. a) Product summary Parvolex® injection. Last revised June 2010
b) Acetylcysteine 200mg/mL concentrate for solution for infusion. Teva. Last revised 08/02/2011.
c) Acetylcysteine 200mg/mL concentrate for solution for infusion, Martindale Pharmaceuticals (Aurum). Last revised 06/12/2005
2. Martindale "The Complete Drug Reference" 37th Edition, 2011, pg 1687-1689
3. American Hospital Formulary Service Drug Information
4. Trissel "Handbook on Injectable Drugs" 16th Edition pg 5-6
5. British National Formulary 63, March 2012, pg 37
6. Medicines for Children 2003 produced by the Royal College of Paediatric & Child Health 2003
a) British National Formulary for Children 2011-12 pg 28
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer.
9. a) Drug company name: UCB Pharma. Date contacted: 17/08/2012
b) Drug company name: Teva UK Ltd. Date contacted: 15/06/2012
c) Drug company name: Martindale Pharma (Aurum). Date contacted: 01/05/2012

Version 5.1 (NHS Lothian local amendment)

Intravenous Aciclovir powder for reconstitution for intravenous infusion

MEDICINE NAME:

Aciclovir

TRADE NAME(S):

Zovirax®, GlaxoSmithKline UK
Aciclovir (Wockhardt UK Ltd)

PRESENTATION OF MEDICINE:

Vials containing aciclovir 250mg (as sodium) powder for reconstitution ^(1a-b)

Vials containing aciclovir 500mg (as sodium) powder for reconstitution ^(1a)

METHOD OF ADMINISTRATION:

ADULTS, CHILDREN AND NEONATES

Do not administer by IV injection (to avoid renal damage)

IV infusion: Give over at least one hour. ^(1a-b)

Preferably via a central venous access device to avoid potential venous irritation as the preparation has a high pH. ⁽¹³⁾ If a central venous access device is unavailable a risk benefit analysis should be made on an individual patient basis. If given peripherally, the insertion site must be monitored closely for phlebitis using recognised infusion phlebitis scoring tool.

Discard the solution if it becomes cloudy or crystals appear before or during the infusion. ^(1a-b)

INSTRUCTIONS FOR RECONSTITUTION:

250mg vial: Add 10mL water for injections or sodium chloride 0.9% to the contents of the 250mg vial to obtain a solution containing 25mg in 1mL. ^(1a-b)

500mg vial: Add 20mL water for injections or sodium chloride 0.9% to the contents of the 500mg vial to obtain a solution containing 25mg in 1mL.

Shake the vial gently until the powder is completely dissolved. The reconstituted solution is light yellow and slightly opalescent. ^(1a)

After reconstitution the 25mg in 1mL aciclovir solution may require further dilution, unless administering to fluid restricted patients. ^(1a-b)

DISPLACEMENT VALUE:

250mg displaces 0.2mL ^(9a-b)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

The reconstituted solution may be further diluted with sodium chloride 0.9%. ^(1a-b)

ADULTS:

Dilute doses of between 250mg and 500mg in 100mL of sodium chloride 0.9%. Dilute doses of between 500mg and 1g in 250mL of sodium chloride 0.9%. Do not dilute to a concentration greater than 5mg in 1mL. ^(1a-b)

In fluid restricted patients only, aciclovir may be given undiluted (25mg in 1mL) via a central venous access device using a syringe pump. ^{(1a-b)(11)}

CHILDREN AND NEONATES:

Dilute doses to a maximum concentration of 5mg in 1mL, e.g. 100mg in 20mL infusion fluid.^(1a-b)

Shake the prepared infusion well to ensure adequate mixing occurs.^(1a-b)

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

12 hours.^(1a-b)

FLUSHING:

Sodium chloride 0.9%.^(1a-b)

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Phlebitis, severe local inflammation (sometimes leading to ulceration of the skin), fever, nausea, vomiting, and anaphylaxis.^{(1a)(2)(5)}

Rapid administration can cause rapid increases in blood urea and creatinine levels. Avoid by slow infusion over one hour and ensuring adequate hydration.^(1a-b)

EXTRAVASATION:

Aciclovir has the potential to cause tissue damage due to the high pH.^{(8a)(10)(12)}

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusions (it is assumed that medicines meet close to the canula insertion site): Amikacin, ampicillin, cefotaxime, ceftazidime, ceftriaxone, cefuroxime, chloramphenicol, clindamycin, co-trimoxazole, dexamethasone, doxycycline, erythromycin, filgrastim, fluconazole, gentamicin, granisetron, heparin, hydrocortisone, imipenem with cilastatin, linezolid, lorazepam, magnesium sulfate, methylprednisolone, metoclopramide, metronidazole, milrinone, potassium chloride infusion, ranitidine, remifentanyl, tobramycin sulfate, vancomycin, zidovudine.⁽⁴⁾

Sodium chloride 0.18% and glucose 4%, sodium chloride 0.45% and glucose 2.5%, sodium lactate compound (Hartmann's).^(1a0b)

Incompatible: Aztreonam, diltiazem, dobutamine, dopamine, levofloxacin, meropenem, morphine, ondansetron, pethidine, piperacillin with tazobactam sodium, tacrolimus.^{(1a-b)(4)}

The following are usually incompatible, infuse separately if possible. Parenteral nutrition solutions, sodium bicarbonate infusions, phosphate preparations, blood components, plasma substitutes.

SPECIAL HANDLING PRECAUTIONS:

Highly discomforting to the eyes; may cause temporary redness and pain. Mildly discomforting or moderately irritating to skin. Avoid contact with eyes and unprotected skin.⁽⁸⁾

SODIUM CONTENT (mmol):

1.1mmol sodium per 250mg vial ^{(1a-b)(9a)}

2.2mmol sodium per 500mg vial. ^(9a)

OSMOLARITY / OSMOLALITY:

324-349mOsm/L (in sodium chloride 0.9%) (Zovirax) Also see link.⁽¹²⁾

pH:

Reconstituted aciclovir solution has a pH of approximately 11.^(1a-b)

OTHER COMMENTS:

1. Do not refrigerate the reconstituted or diluted solution as precipitation may occur.^(1a-b)
2. Do not store vials above 25°C.^(1a-b)

REFERENCES:

1. Summary of Product Characteristics
 - a) Zovirax® IV 250mg and 500mg (GlaxoSmithKline) last revised November 2012
 - b) Aciclovir 250mg powder for solution (WockhardtUK Ltd) last updated January 2012
2. Martindale, accessed via www.medicinescomplete.com November 2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com November 2012
4. Trissel "Handbook on injectable drugs" 15th Edition accessed November 2012
5. British National Formulary No. 64, September 2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2012-2013 accessed via <http://bnfc.org/bnfc> November 2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
 - a) GlaxoSmithKline supplied November 2012
 - b) Wockhardt, supplied November 2012
9.
 - a) Drug company name: GlaxoSmith Kline. Date contacted: 16/11/2012
 - b) Drug company name: Wockhardt. Date contacted: 16/11/2012
10. www.extravasation.org.uk
11. UKCPA Minimum Volumes Guide 3rd Edition, 2006
12. Quality Assurance department, Charing Cross Hospital. July 2010.
13. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Intravenous

Aciclovir intravenous infusion (concentrated solution)

MEDICINE NAME:

Aciclovir

TRADE NAME(S):

Aciclovir sterile concentrate solution - Hospira UK Ltd

PRESENTATION OF MEDICINE:

Vials containing aciclovir 250mg in 10mL (as sodium) concentrate for infusion or dilution.⁽¹⁾

Vials containing aciclovir 500mg in 20mL (as sodium) concentrate for infusion or dilution.⁽¹⁾

Vials containing aciclovir 1g in 40mL (as sodium) concentrate for infusion or dilution.⁽¹⁾

METHOD OF ADMINISTRATION:

ADULTS, CHILDREN AND NEONATES

Do not administer by IV Injection (to avoid renal damage)

IV infusion: Give over at least one hour.⁽¹⁾

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a high pH.⁽¹³⁾ If a central venous access device is unavailable a risk benefit analysis should be made on an individual patient basis. If given peripherally the insertion site must be monitored closely for phlebitis using a recognised infusion phlebitis scoring tool.

Discard the solution if it becomes cloudy or crystals appear before or during the infusion.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

ADULTS:

Dilute doses of between 250mg and 500mg in a 100mL of sodium chloride 0.9%. Dilute doses of between 500mg and 1g in a 250mL of sodium chloride 0.9%. Do not dilute to a concentration greater than 5mg in 1mL.⁽¹⁾

In fluid restricted patients only aciclovir may be given undiluted (25mg in 1mL) via a central venous access device using a syringe pump.⁽¹⁾⁽¹¹⁾

CHILDREN AND NEONATES:

Dilute doses to a maximum concentration of 5mg in 1mL, e.g. 100mg in 20mL sodium chloride 0.9%.⁽¹⁾

Shake the prepared infusion well to ensure adequate mixing occurs.⁽¹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

12 hours after dilution.⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9%.⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Phlebitis, severe local inflammation (sometimes leading to ulceration of the skin), fever, nausea, vomiting and anaphylaxis.⁽¹⁾⁽²⁾⁽⁵⁾

Rapid administration can cause rapid increases in blood urea and creatinine levels. Avoided by slow infusion over one hour and ensuring adequate hydration.⁽¹⁾

EXTRAVASATION:

Aciclovir has the potential to cause tissue damage due to the high pH.⁽⁹⁾⁽¹²⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusions (it is assumed that medicines meet close to the canula insertion site): Amikacin, ampicillin, cefotaxime, ceftazidime, ceftriaxone, cefuroxime, chloramphenicol, clindamycin, co-trimoxazole, dexamethasone, doxycycline, erythromycin, filgrastim, fluconazole, gentamicin, granisetron, heparin, hydrocortisone, imipenem with cilastatin, linezolid, lorazepam, magnesium sulfate, methylprednisolone, metoclopramide, metronidazole, milrinone, potassium chloride infusion, propofol, ranitidine, remifentanyl, tobramycin sulfate, vancomycin, zidovudine.⁽⁴⁾

Sodium chloride 0.18% and glucose 4%, sodium chloride 0.45% and glucose 2.5%, sodium chloride 0.9% and glucose 5%, sodium lactate compound (Hartmann's).⁽¹⁾

Incompatible: Aztreonam, diltiazem, dobutamine, dopamine, levofloxacin, meropenem, morphine, ondansetron, pethidine, piperacillin with tazobactam sodium, tacrolimus.⁽¹⁾⁽⁴⁾

The following are usually incompatible, infuse separately if possible. Parenteral nutrition solutions, sodium bicarbonate infusions, phosphate preparations, blood components, plasma substitutes.

SPECIAL HANDLING PRECAUTIONS:

Highly discomforting to the eyes, may cause temporary redness and pain. Mildly discomforting or moderately irritating to skin.⁽⁸⁾ Avoid contact with eyes and unprotected skin.⁽¹⁾

SODIUM CONTENT (mmol):

1.16mmol for 250mg vial.⁽⁹⁾

2.32mmol for 500mg vial.⁽⁹⁾

4.64mmol for 1g vial.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Osmolarity

324mOsmol/L for aciclovir 500mg in 250ml of sodium chloride 0.9% .⁽¹²⁾ .

pH:

pH 10.5 to 11.7.⁽⁹⁾⁽¹²⁾

OTHER COMMENTS:

1. Do not refrigerate as precipitation may occur.⁽⁴⁾
2. Do not store vials above 25°C.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Aciclovir 25mg/mL Sterile Concentrate (Hospira UK

- Ltd), last revised July 2009
2. Martindale accessed via <http://www.medicinescomplete.com> November 2012
 3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> November 2012
 4. Trissel "Handbook on injectable drugs" 15th Edition accessed via <http://www.medicinescomplete.com> November 2012
 5. British National Formulary No. 64, accessed via www.bnf.org November 2012
 6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2012-2013 accessed via <http://bnfc.org/bnfc> November 2012
 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
 8. COSHH report compiled by manufacturer, Hospira September 2011
 9. Drug company name: Hospira UK Ltd. Date contacted: 09/11/2012
 10. www.extravasation.org.uk
 11. UKCPA Minimum Volumes Guide 4th Edition 2012
 12. Quality Assurance department, Charing Cross Hospital. July 2010.
 13. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 6

Intravenous

Adrenaline/epinephrine

Commercially available preparations of adrenaline 1 in 1,000 (1mg in 1mL) are currently not licensed for administration via the IV route

MEDICINE NAME:

Adrenaline (epinephrine)

TRADE NAME(S):

Non proprietary available from:
Cardinal Health Martindale Products
Goldshield plc
Hameln Pharmaceuticals Ltd
UCB Pharma (was IMS UK) Ltd

PRESENTATION OF MEDICINE:

Preparations used for administration by IV injection: Use adrenaline 1 in 10,000 (100micrograms in 1mL).

Ampoules containing adrenaline 1 in 10,000 available as 1mL (100microgram in 1mL), 5mL (500micrograms in 5mL) and 10mL (1mg in 10mL) ampoules.^(1a)

Prefilled syringes containing adrenaline 1 in 10,000 available as 3mL (300microgram in 3mL) and 10mL (1mg in 10mL) syringes.^(1e)

Preparations used to prepare an infusion of adrenaline: Use adrenaline 1 in 1,000 (1mg in 1mL) to prepare an infusion if ready prepared infusions are unavailable.

Ampoules containing adrenaline 1 in 1,000 available as 0.5mL (0.5mg in 0.5mL),^(1b) 1mL (1mg in 1mL)^(1b-d) and 5mL (5mg in 5mL).^(1b)

METHOD OF ADMINISTRATION:

IV injection for resuscitation or critically low blood pressure whilst waiting for an infusion to be prepared:

Give by rapid IV injection. Administer via a central venous access device if already in place, or into a large peripheral vein. IV injection administered via a peripheral vein should be followed by a 20mL flush of sodium chloride 0.9%.⁽⁵⁾⁽¹¹⁾

IV injection for anaphylaxis (N.B. IM injection should usually be used for anaphylaxis):

Give by rapid IV injection. Administer via a central venous access device if already in place, or into a large peripheral vein. IV injection administered via a peripheral vein should be followed by a 20mL flush of sodium chloride 0.9%.⁽⁵⁾⁽¹¹⁾

IV infusion:

Infuse via a central venous access device using an infusion pump. Adrenaline infusions are potent and should be commenced at a low dose and the rate increased according to the blood pressure.

A replacement infusion must always be prepared before the infusion being administered is completed.

When the infusion is discontinued, do not flush the vascular access device. Disconnect the administration set, aspirate the vascular access device contents and then flush with sodium chloride 0.9%.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV injection:

Use adrenaline 1 in 10,000 (100micrograms in 1mL).

IV infusion:

If ready prepared infusions are unavailable use adrenaline 1 in 1,000 (1mg in 1mL) and dilute with sodium chloride 0.9% or glucose 5% to produce the following suggested concentrations: ⁽¹²⁾

ADMINISTRATION VIA A SYRINGE PUMP: A concentration of 4mg in 50mL solution is usually used. In some circumstances it may be necessary to prepare a concentration of 8mg in 50mL or 16mg in 50mL. ⁽¹²⁾

ADMINISTRATION VIA A VOLUMETRIC PUMP: A concentration of 8mg in 100mL is usually used. In some circumstances it may be necessary to prepare a concentration of 16mg in 100mL or 32mg in 100mL. ⁽¹²⁾

Paediatrics

Dilute 3mg/kg body-weight to a final volume with 50mL sodium chloride 0.9% or glucose 5%. ^(6a)

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

24 hours when prepared in the clinical area.

EXAMPLE CALCULATION:

Infusion rate: The infusion rate can be calculated from the following equation:

$$\text{Adrenaline Infusion rate (mL/hour)} = \frac{\text{Dose (micrograms/kg/minute)} \times \text{patient weight (kg)} \times 60 \text{ (minutes)}}{\text{Concentration (micrograms/mL)}}$$

For example: To administer a dose of 0.1micrograms/kg/minute of adrenaline to a 70kg patient using a solution of 4mg in 50mL (80micrograms in 1mL), the calculation would look as follows:

$$\text{Adrenaline Infusion rate (mL/hour)} = \frac{0.1(\text{micrograms/kg/minute}) \times 70 \text{ (kg)} \times 60 \text{ (minutes)}}{80 \text{ (micrograms/mL)}} = 5.25\text{mL/hour}$$

NB: Infusion pumps can only be set to one decimal place. If the calculation produces a figure to two decimal places when setting the infusion pump figures of 0.05 and above should be rounded UP to the next decimal place and figures below 0.05 should be rounded DOWN. E.g. 5.25mL/hour should be rounded up to 5.3mL/hour.

FLUSHING:

Compatible flushes are sodium chloride 0.9% or glucose 5%

IV injection via a peripheral venous catheter Follow injection with a 20mL flush of sodium chloride 0.9%. ⁽⁵⁾⁽¹¹⁾

Infusion: Do not flush the vascular access device. After the infusion is discontinued, disconnect the administration set, aspirate the vascular access device contents and then flush with sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Arrhythmias including VT and VF. Extreme hypertension leading to cerebral haemorrhage and pulmonary oedema.⁽²⁾⁽³⁾ Anxiety, dyspnoea, restlessness, palpitations, tachycardia, anginal pain, tremor, weakness, dizziness, headache, cold extremities.⁽²⁾⁽³⁾ Peripheral ischaemia. Hyperglycaemia.⁽²⁾

Prolonged use of adrenaline may result in severe metabolic acidosis due to elevated blood concentrations of lactic acid.⁽³⁾

Ampoules contain sodium metabisulphite that can cause allergic type reactions including anaphylaxis and asthmatic episodes in susceptible individuals.⁽³⁾

Monitoring: Continuous blood pressure and ECG monitoring required. When administered via an infusion use invasive blood pressure monitoring and monitor blood glucose.

EXTRAVASATION:

Tissue infiltration may lead to local ischaemia. Tissue necrosis may occur due to low pH. Administer via a central venous access device if possible. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet in the administration set close to the cannula insertion site): Amiodarone (amiodarone must be diluted with glucose 5%), atracurium, cisatracurium, clonidine, dopamine, fentanyl, heparin sodium, lorazepam, midazolam, milrinone, morphine sulphate, noradrenaline, potassium chloride, propofol, vasopressin, vecuronium.⁽⁴⁾

Incompatible: Adrenaline should not be mixed with sodium bicarbonate.^{(1c)(1e)}

Adrenaline is incompatible with halogens, nitrates, nitrites and salts of iron, copper and zinc. Adrenaline may be mixed with sodium chloride 0.9% but is incompatible with sodium chloride 5% injection. The stability of adrenaline in glucose 5% decreases when the pH is greater than 5.5.^(1c)

Compatible with the following infusion fluids:

Glucose 10%, glucose 4% and sodium chloride 0.18% and compound sodium lactate (Hartmann's).⁽⁴⁾

SODIUM CONTENT (mmol):

0.01 - 0.2mmol/mL (Martindale, Hameln, Goldshield, UCB Pharma)^(9a-d)

OSMOLARITY / OSMOLALITY:

0.1mg/mL solution 273mOsm/kg⁽⁴⁾

1mg/mL solution 348mOsm/kg⁽⁴⁾

pH:

- 2.5 to 3.6 (Martindale)^(9a)
- 2.8 to 3.6 (Hameln)^(9b)
- 3.3 to 3.6 (Goldshield)^(9c)
- 2.2 to 5 (UCB Pharma)^(9d)

OTHER COMMENTS:

1. During storage keep adrenaline preparations in outer carton to protect from light.

REFERENCES:

1. Summary of Product Characteristics
 - a) Adrenaline Injection 1 in 10,000. Macarthy's Laboratories Ltd T/A Martindale Pharmaceuticals. Last revised 18/11/2009
 - b) Adrenaline Injection 1:1,000. Macarthy's Laboratories Ltd T/A Martindale Pharmaceuticals. Last revised 24/02/2009
 - c) Adrenaline (Epinephrine) Injection BP 1 in 1000. Hameln Last revised 06/08/2009
 - d) Adrenaline (Epinephrine) Injection BP 1 in 1000. Goldshield Last revised Jul 2009
 - e) Epinephrine (Adrenaline) Injection 1:10,000. International Medication Systems (UK) Ltd (UCB Pharma) Last revised: 14th October 2005
2. Martindale accessed via www.medicinescomplete.com on 02/02/2011
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 02/02/2011
4. Trissel "Handbook On Injectable Drugs" 15th Edition pg 603-610
5. British National Formulary No. 60 (September 2010) pg 138
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003
 - a) British National Formulary for Children 2010-11 pg 941
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
9.
 - a) Drug company name: Cardinal Health Martindale Pharma. Date contacted: 08/02/2011
 - b) Drug company name: Hameln. Date contacted: 16/02/2011
 - c) Drug company name: Goldshield. Date contacted: 08/02/2011
 - d) Drug company name: UCB Pharma. Date contacted: 10/02/2011
10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
11. Resuscitation Council (UK) Website www.resus.org.uk
12. Intensive Care Society website statement supporting use of standard infusion concentrations (2010) [See Link](#)

Version 5

Intravenous

Albumin solution, human, isotonic

Record the batch number and expiry date from each unit used in the patient's case notes or drug chart.

A separate monograph for human albumin solution (concentrated) is available.

MEDICINE NAME:

Albumin solution, human, isotonic

TRADE NAME(S):

Human albumin solution 50g/litre (Baxter)
Human Albumin Biotest 5%
Albunorm® 5%
Alburex® 5
Zenalb® 4.5

PRESENTATION OF MEDICINE:

Human albumin solution 4.5% (45g in 1L)

Glass vial/bottle containing human albumin solution 2.25g in 50mL, 4.5g in 100mL, 11.25g in 250mL, 22.5g in 500mL (Zenalb® 4.5 only).^(1d)

Human albumin solution 5% (50g in 1L)

Glass vial/bottle containing human albumin)

5g in 100mL (Albunorm®, Alburex®).^{(1b)(1f)}

12.5g in 250mL (Albunorm®, Alburex®, Baxter, Biotest).^{(1b-c)(1e-f)}

25g in 500mL (Albunorm®, Alburex®, BAXter, Biotest).^{(1b-c)(1e-f)}

METHOD OF ADMINISTRATION:

IV Infusion

give undiluted.^(1a-f) Adjust infusion rate according to indication and patient response but in general, a rate of up to 5mL/minute is suggested for a 5% concentration.⁽²⁾

In plasma exchange, adjust the infusion rate to the rate of removal.^(1a-f)

STABILITY:

Prepare immediately before administration.

FLUSHING:

Glucose 5%, sodium chloride 0.9%⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

- Allergic or anaphylactic-type reactions - stop the infusion immediately.^(1a-f)
- Mild reactions including flushing, urticaria, fever, nausea,^(1a-f) skin rash,^(1c) vomiting, increased salivation, hypotension, febrile reactions and tachycardia are rare⁽²⁾ and normally disappear rapidly when the infusion is slowed or stopped.^(1a-f)
- Hypervolaemia may occur if the dose and rate of infusion are too high. Stop the infusion at the first clinical signs of cardiovascular overload (e.g. headache, dyspnoea, jugular vein congestion) or increased blood pressure, raised central venous pressure and pulmonary oedema.^(1a-f)

Monitoring:

- Monitor cardiovascular and respiratory function: this might include arterial blood pressure and pulse rate, central venous pressure, pulmonary artery wedge pressure, urine output, and haematocrit/haemoglobin.^(1a-f)
- Monitor electrolytes.^(1a-f)
- Monitor coagulation parameters and haematocrit if large volumes of fluid are being replaced and ensure adequate substitution of other blood constituents (e.g. coagulation factors, electrolytes, platelets and erythrocytes).^(1a-f)
- Observe injured or postoperative patients carefully as the rise in blood pressure could result in bleeding from undetected sites.⁽²⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:**Compatible with the following infusions (It is assumed that the infusions mix close to the vascular access device)**

sodium chloride 0.9% and glucose 5%.⁽⁴⁾

Incompatible:

Do not mix with other medicines, whole blood or packed red cells, parenteral nutrition solutions, or solutions containing alcohol. Do not dilute with water for injections as this may result in potentially life-threatening haemolysis.^(1a-f)

SODIUM CONTENT (mmol):

Solutions contain up to 16mmol sodium in 100mL (160mmol/L).⁽²⁾ The sodium content for individual products is:

Human albumin solution 50g/L (Baxter): 13-16mmol in 100mL.^(1c)

Human Albumin Biotest 5%: 14.5mmol in 100mL.^(1e)

Albunorm® 5%: 14-16mmol in 100mL.^(1b)

Alburex®: 14mmol in 100mL.^(9d)

Zenalb® 4.5%: 10-16mmol in 100mL.^(1d)

OSMOLARITY / OSMOLALITY:

Human albumin solutions 40-50g in 1L are iso-osmotic⁽²⁾ with and mildly hypo-oncotic to normal plasma.^(1a-f)

260mOsm/Kg (Alburex®).^(1f)

pH:

6.7 to 7.3.⁽²⁾

OTHER COMMENTS:

1. Do not store above +25°C.^(1b-f)
2. Store in the original container to protect from light.^(1a-f)
3. Do not freeze; do not use solutions that have been frozen.⁽³⁾
4. Do not use solutions which are cloudy or have deposits.^(1a-f)
5. Contains no more than 200micrograms aluminium in 1L.⁽²⁾
6. Warm to room or body temperature before use if large volumes are to be given.^(1a-f)

REFERENCES:

1. a) Committee for Medicinal Products for Human Use (CHMP). Guidelines on the Core SPC for Human Albumin Solution. Revision 2. European Medicines Agency, London 17 November 2005, accessed February 2011
Summary of Product Characteristics
b) Alunorm® 5%. Last revised 03/2011
c) Human albumin solution 50g/L, Baxter. Last revised 01/08/2012
d) Zenalb® 4.5. Last revised September 2008
e) Human albumin Biotest 5%. Last revised 24/02/2009
f) Alburex®. Last revised 12/08/2010
2. Martindale accessed via www.medicinescomplete.com on 24/08/2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 24/08/2012
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 24/08/2012
5. British National Formulary No. 63 March 2012 electronic version
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2012-2013, electronic version
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
a) Zenalb® 4.5 Material Safety Data Sheet, BPL, revised March 2010
b) Alunorm® Safety Data Sheet, Octapharma, revised 15/12/2009
9. a) Drug company name: Octapharma. Date contacted: August 2011
b) Drug company name: Bio Products Laboratory. Date contacted: February 2011
c) Drug company name: Baxter Healthcare Ltd. Date contacted: February 2011
d) Drug company name: CLS Behring UK Ltd. Date contacted: September 2012

Version 2 (NHS Lothian local amendment)

Intravenous

Albumin solution, human, concentrated

Record the batch number and expiry date from each unit used in the patient's case notes or drug chart.

A separate monograph for human albumin solution (isotonic) is available.

MEDICINE NAME:

Albumin solution, human, concentrated

TRADE NAME(S):

Human Albumin solution 200g/L Baxter
Human Albumin Biotest 20%
Albunorm® 20%
Alburex® 20
Flexbumin® 200g/L
Zenalb® 20

PRESENTATION OF MEDICINE:

Glass vial/bottle containing human albumin 10g in 50mL and 20g in 100mL solution.^{(1b-c)(1e-g)}

Polythene bag containing human albumin 10g in 50mL or 20g in 100mL solution (Flexbumin® only).^(1d)

METHOD OF ADMINISTRATION:

IV Infusion: Give diluted or undiluted.^(1a-g) Infuse slowly, adjusting the rate according to indication, patient response and dilution used, but in general, a rate of up to 1 to 2mL/minute is suggested for a 20% concentration.⁽²⁾

In plasma exchange, adjust the infusion rate to the rate of removal.^(1a-g)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Dilute with glucose 5% or sodium chloride 0.9% (or other isotonic solution) if dilution is required.^(1a-g) Use glucose 5% if sodium restriction is necessary. Use sodium chloride 0.9% if large volumes are likely to be given (e.g. during plasmapheresis or plasma exchange) if the fluid and electrolyte status of the patient permits.⁽³⁾

STABILITY:

Prepare immediately before administration.

FLUSHING:

Flush with glucose 5% or sodium chloride 0.9%⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

- Allergic or anaphylactic-type reactions - stop the infusion immediately.^(1a-g)
- Mild reactions including flushing, urticaria, fever, nausea,^(1a-g) skin rash,^(1e) vomiting, increased salivation, hypotension, febrile reactions and tachycardia are rare⁽²⁾ and normally disappear rapidly when the infusion is slowed or stopped.^(1a-g)
- Hypervolaemia may occur if the dose and rate of infusion are too high. Stop the infusion at the first clinical signs of cardiovascular overload (e.g. headache, dyspnoea, jugular vein congestion)

or increased blood pressure, raised central venous pressure and pulmonary oedema.^(1a-g)

Monitoring:

- Monitor cardiovascular and respiratory function: this might include arterial blood pressure and pulse rate, central venous pressure, pulmonary artery wedge pressure, urine output, and haematocrit/haemoglobin.^(1a-g)
- Monitor electrolytes and take appropriate steps to restore or maintain balance.^(1a-g)
- Monitor coagulation parameters and haematocrit if large volumes of fluid are being replaced and ensure adequate substitution of other blood constituents (e.g. coagulation factors, electrolytes, platelets and erythrocytes).^(1a-g)
- Observe injured or postoperative patients carefully as the rise in blood pressure could result in bleeding from undetected sites.⁽²⁾
- Ensure adequate hydration of the patient^(1a-g) as concentrated human albumin solution is hyperosmotic with respect to plasma.⁽²⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible with the following infusions (It is assumed that infusions mix close to the vascular access device): Sodium chloride 0.9% and glucose 5%.⁽⁴⁾

Incompatible: Do not mix with other medicines, whole blood or packed red cells,^(1a-g) parenteral nutrition solutions or solutions containing alcohol.^(1d) Do not dilute with water for injections as this may result in potentially life threatening haemolysis.^(1a-g)

SODIUM CONTENT (mmol):

Solutions contain up to 16mmol sodium in 100mL (160mmol/L).⁽²⁾

The sodium content for individual products is:

Albunorm®: 14-16mmol in 100mL.^(1c)

Alburex®: 14mmol in 100mL.^(9d)

Flexbumin®: 13-16mmol/L.^(1d)

Human albumin 200g/L Baxter: 10-13mmol in 100mL.^(1c)

Human Albumin Biotest 20%: 12.2mmol in 100mL.^(1f)

Zenalb® 20: 5-12mmol in 100mL.^(1b)

OSMOLARITY / OSMOLALITY:

250-400mOsm/Kg (Albunorm® 20%).^(9a)

150mOsm/Kg (Zenalb® 20).^(9b)

260mOsm/Kg (Alburex®).^(1g)

pH:

pH 6.7 to 7.3⁽²⁾

OTHER COMMENTS:

1. Do not store above +25°C.^(1b-g)
2. Store in the original container to protect from light.^(1a-g)
3. Do not freeze; do not use solutions that have been frozen.⁽³⁾
4. Do not use solutions that are cloudy or have deposits.^(1a-g)
5. Contains not more than 200micrograms aluminium in 1L.⁽²⁾
6. Warm to room or body temperature before use if large volumes are to be given.^(1a-g)

REFERENCES:

1. a) Committee for Medicinal Products for Human Use (CHMP). Guidelines on the Core SPC for Human albumin solution, Revision 2. European Medicines Agency, London 17 November 2005 accessed February 2011
Summary of Product Characteristics
b) Zenalb® 20. Last revised September 2008
c) Alburnorm®. Last revised 03/2011
d) Flexbumin. Last revised 05/04/2012
e) Human albumin solution 200g/L Baxter. Last revised October 2006
f) Human Albumin Biotest 20%. Last revised 24/02/2009
g) Alburex®. Last revised 12/08/2010
2. Martindale accessed via <http://www.medicinescomplete.com/mc/> on 24/08/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com/mc/> on 24/08/2012
4. Trissel "Handbook on Injectable drugs" accessed via <http://www.medicinescomplete.com> on 24/08/2012
5. British National Formulary No. 63 March 2012 electronic version
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2012-2013 electronic version
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
a) Zenalb® 20, Material Safety Data Sheet, BPL, Revised March 2010
b) Alburnorm® Safety Data Sheet, Octapharma, revised 15/12/2009
9. a) Drug company name: Octapharma. Date contacted: August 2012
b) Drug company name: Bio Products Laboratory (BPL). Date contacted: February 2011
c) Drug company name: Baxter Healthcare Ltd. Date contacted: February 2011
d) Drug company name: CSL Behring UK Ltd. Date contacted: September 2012

Version 2 (NHS Lothian local amendment)

Intravenous

Alfentanil

MEDICINE NAME:

Alfentanil

TRADE NAME(S):

Rapifen®

Rapifen Intensive Care®

Non-proprietary available from Hameln and Auden McKenzie

PRESENTATION OF MEDICINE:

Ampoules containing alfentanil 1mg in 2mL

Ampoules containing alfentanil 5mg in 10mL

Ampoules containing alfentanil 5mg in 1mL. Concentrate for dilution.

METHOD OF ADMINISTRATION:

IV injection: Administer by bolus injection over about 30 seconds. Dilution may be helpful.

IV infusion: Administer using an infusion pump, Only give by infusion in ventilated patients.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV injection: Alfentanil 500micrograms in 1mL can be administered without further dilution or can be diluted to any convenient volume with sodium chloride 0.9% or glucose 5%.

Infusion: In adults, suggested standard concentration for use in Critical Care is 25mg in 50mL.⁽¹⁰⁾
Use either:

5 x 5mg in 10mL ampoules undiluted **OR**

5 x 5mg in 1mL ampoules diluted to 50mL. Suitable diluents are sodium chloride 0.9% or glucose 5%⁽¹⁾

Alfentanil 5mg in 1mL must be always diluted before use.

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

Use within 24 hours of preparation.⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5% ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypotension (may be exaggerated in the hypovolaemic patient or in the presence of concomitant sedative medication): monitor, consider reducing rate of infusion and use appropriate measures to maintain stable arterial pressure.⁽¹⁾

Respiratory depression; dose related, usually occurs following administration of doses in excess of 1mg, can be reversed by naloxone.

Bradycardia: monitor, consider reducing rate of infusion and consider use of anticholinergic such as atropine.⁽¹⁾

Hypoventilation or apnoea: consider oxygen, assisted or controlled respiration and use of an opioid antagonist e.g. naloxone.⁽¹⁾

Muscle rigidity during induction can be avoided by giving injection slowly, by premedicating with a benzodiazepine, by administration of a muscle relaxant just prior to administration of alfentanil. If rigidity occurs consider use of neuromuscular blocking agent.⁽¹⁾

Injection site pain

Allergic reactions (e.g. anaphylaxis, bronchospasm, urticaria)

EXTRAVASATION:

Extravasation may cause tissue damage due to low pH. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Atracurium besylate, midazolam hydrochloride, morphine sulphate, ondansetron hydrochloride.⁽⁴⁾

Compatible with the following diluents/infusion fluids in addition to those listed above: Compound sodium lactate (Hartmann's)

Incompatible: No information available.

SPECIAL HANDLING PRECAUTIONS:

No special handling precautions ⁽⁸⁾

SODIUM CONTENT (mmol):

Negligible

pH:

4.3 to 6.0 ⁽⁹⁾ Rapifen®

4.0 to 6.0 ⁽⁴⁾ Rapifen®

4.0 to 6.0 ⁽⁹⁾ Rapifen Intensive Care®

OTHER COMMENTS:

1. Adequate plasma levels in ventilated patients will only be achieved rapidly if the infusion (0.5-1microgram/kg/minute) is preceded by a loading dose of 50-100micrograms/kg given as a bolus or fast infusion over 10 minutes.⁽¹⁾

OTHER INJECTABLE ROUTES OF ADMINISTRATION:

Used off-label in Palliative Care by subcutaneous Injection and continuous subcutaneous Infusion. For use under specialist supervision only. See latest edition of Lothian Palliative Care Guidelines for further information.

REFERENCES:

1. Summary of Product Characteristics, Rapifen 2007, Rapifen Intensive Care 2005
2. Martindale 'The Complete Drug Reference' 34th edition
3. American Hospital Formulary Service Drug Information - reference not used
4. Trissel 'Handbook on injectable drugs' 13th edition
5. British National Formulary Number 54

6. Royal College of Paediatrics & Child Health 'Medicines for Children' 2003
 - a) British National Formulary for Children 2007
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
9. Drug company name: Janssen
Date contacted: 25/07/2007
10. Standard concentrations for infusions used in critical care areas. The Intensive Care Society website (2010) [See Link](#)

Version 3 (local amendment for NHS Lothian)

Intravenous

Alteplase

N.B. Two different alteplase products are available. Actilyse® is for therapeutic use and Actilyse Cathflo® is used for occluded central venous access devices. Ensure that you are using the correct product for the required indication

MEDICINE NAME:

Alteplase
(rt-PA tissue-type plasminogen activator)

TRADE NAME(S):

Actilyse®
Actilyse Cathflo®

PRESENTATION OF MEDICINE:

Alteplase (Actilyse®) for therapeutic use

Vial containing alteplase 10mg powder for reconstitution.^{(1a)(5)} Plus 10mL vial containing water for injections for reconstitution.^(1a)

Vial containing alteplase 20mg powder for reconstitution.^{(1a)(5)} Plus 20mL vial containing water for injections for reconstitution.^(1a)

Vial containing alteplase 50mg powder for reconstitution.^{(1a)(5)} Plus 50mL vial containing water for injections for reconstitution.^(1a)

Alteplase (Actilyse Cathflo®) for occluded central venous access devices.

Vial containing alteplase 2mg powder for reconstitution.^(1b) Plus 2.2mL vial containing water for injections for reconstitution.^(1b)

METHOD OF ADMINISTRATION:

MYOCARDIAL INFARCTION (90 minutes (accelerated) regimen for patients with myocardial infarction, in whom treatment can be started within 6 hours after symptom onset):

Initially an **IV injection** over 3 to 5 minutes, followed by **IV infusion** over 30 minutes, followed by a further **IV infusion** over 60 minutes.^{(1a)(5)}

MYOCARDIAL INFARCTION (3 hour regimen for patients with myocardial infarction, in whom treatment can be started between 6 and 12 hours after symptom onset):

Initially an **IV injection** over 3 to 5 minutes, followed by an **IV infusion** over 60 minutes and then followed by **IV infusions** over 30 minutes each until maximum dose is reached.^{(1a)(5)}

PULMONARY EMBOLISM:

Initially an **IV injection** over 1 to 2 minutes, followed by an **IV infusion** over 2 hours.^{(1a)(5)}

Note for patients weighing less than 65kg body weight - The total dose should not exceed 1.5mg/kg.^(1a) The manufacturer makes no specific recommendation on how the reduced dose should be given. They have anecdotal information indicating the most usual method would be to give an initial **IV injection** over 1 to 2 minutes and then adjust the remainder of the total dose, which is given as an **IV infusion** over a 2 hour period.⁽⁹⁾

ACUTE ISCHAEMIC STROKE:

Treatment of alteplase must be started within 4.5 hours of onset of symptoms.^(1a)

IV infusion over 60 minutes with 10% of the total dose given as an initial **IV injection** over 3 to 5 minutes.^{(1a)(5)}

Treatment must be performed by a specialist in neurovascular care.^(1a)

Beyond 4.5 hours after onset of stroke symptoms, there is a negative benefit risk ratio associated with alteplase administration and so it should not be administered.^(1a)

Thrombolytic treatment of occluded central venous access devices:

The reconstituted solution is instilled into the occluded central venous access device. Only 2mg vials of alteplase (Actilyse Cathflo®) are indicated for use in this indication.

The dose used depends on the weight of the patient and may be administered up to two times for any one occlusion. The appropriate dose is instilled into the dysfunctional central venous access device and after 30 minutes of dwell time the catheter function is assessed. If the catheter is not functional, leave for a dwell time of up to 120 minutes then re-assess. If catheter function is not restored after the first dose, a second dose of equal amount may be instilled, repeating the dwell time assessments for the first dose. If after a second dose of alteplase the device remains dysfunctional consider device replacement. If catheter function is restored, aspirate blood (amount depends on patient weight) to remove alteplase solution and residual clot, and gently irrigate the catheter with sodium chloride 0.9 %.^(1b)

INSTRUCTIONS FOR RECONSTITUTION:

10mg vial: Using a syringe, reconstitute with 10mL of water for injections (provided) to obtain a final concentration of 1mg alteplase in 1mL. Alternatively using a syringe, reconstitute with 5mL of water for injections (provided) to obtain a final concentration of 2mg alteplase in 1mL.^(1a)

20mg vial:- Using the transfer device provided, reconstitute with 20mL of water for injections (provided) to obtain a final concentration of 1mg alteplase in 1mL. Alternatively, using a syringe, reconstitute with 10mL of water for injections (provided) to obtain a final concentration of 2mg alteplase in 1mL.^(1a)

50mg vial: Using the transfer device provided, reconstitute with 50mL of water for injections (provided) to obtain a final concentration of 1mg alteplase in 1mL. Alternatively, using a syringe, reconstitute with 25mL of water for injections (provided) to obtain a final concentration of 2mg alteplase in 1mL.^(1a)

2mg vial (Actilyse Cathflo®): Using a syringe, reconstitute with 2.2mL water for injections (provided) to obtain a final concentration of 1mg alteplase in 1mL.^(1b)

When reconstituting alteplase, the mixture should only be agitated gently until completely dissolved.^(1a-b) To prevent foam formation vigorous/excessive agitation should be avoided ^(1a-b)(4) Do not shake.⁽⁴⁾ Slight foaming may occur, however, the bubbles will dissipate after standing for several minutes.⁽⁴⁾ The reconstituted preparation is a clear and colourless to pale yellow solution.^(1a-b)

DISPLACEMENT VALUE:

Displacement value when reconstituted: approximately 1.5mL for the 50mg vial. This is negligible and does not need to be accounted for.⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

The reconstituted solution may be diluted further with sodium chloride 0.9% to a concentration of not less than 0.2mg/1mL.^(1a-b)

STABILITY:

Prepare immediately before administration.

FLUSHING

Flush with sodium chloride 0.9% ^(1a)

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Therapeutic treatment with alteplase

1. Alteplase treatment requires adequate monitoring and should only be used by physicians trained and experienced in the use of thrombolytic treatments and with the facilities to monitor that use. ^(1a)
2. When thrombolytics are used in myocardial infarction, reperfusion arrhythmias and recurrent ischaemia and angina may occur. Reperfusion may also cause cerebral and pulmonary oedema. Hypotension can also occur and can usually be controlled by elevating the patient's legs, or by reducing the rate of infusion or stopping it temporarily, Back pain, fever, and convulsions can also occur.
3. Thrombolytics can cause allergic reactions (including rash, flushing and uveitis) and anaphylaxis has been reported. ⁽⁵⁾
4. For patients receiving alteplase for ischaemic stroke, the manufacturer recommends blood pressure monitoring during administration and for up to 24 hours after. ^(1a)
5. Monitor for injection site haemorrhage (puncture site haemorrhage, catheter site haematoma and catheter site haemorrhage). If severe, discontinuation should be considered. ^(1a)

EXTRAVASATION:

Extravasation during IV infusion of the drug can cause ecchymosis and/or inflammation. Management consists of terminating the infusion at that IV site and application of local therapy. ⁽³⁾ The infusion should be re-commenced using a different site.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Alteplase should not be mixed with other medicinal products in the same infusion vial nor the same catheter. ^(1a)

SPECIAL HANDLING PRECAUTIONS:

No information available ⁽⁹⁾

SODIUM CONTENT (mmol):

Nil ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Osmolarity of the reconstituted solution (1mg/1mL) is approximately 200mOsm/kg. ⁽⁹⁾

pH:

pH of reconstituted solution is 7.3 +/- 0.5 ^(1a-b)

OTHER COMMENTS:

1. Do not store above 25°C. Store in the original package in order to protect from light. ^(1a)

REFERENCES:

1. Summary of Product Characteristics
 - a) Actilyse®, Boehringer Ingelheim Ltd. Date of revision of text November 2011.
 - b) Actilyse Cathflo 2mg. Boehringer Ingelheim Ltd. Date of revision of text November 2010
2. Martindale "The Complete Drug Reference" accessed via Micromedex www.thomsonhc.com/micromedex2 03/05/2012
3. American Hospital Formulary Service Drug Information. Accessed via www.medicinescomplete.com/mc on 13/04/2012
4. Trissel "Handbook on injectable drugs" 15th Edition 2009 accessed via <http://www.medicinescomplete.com/mc>
5. British National Formulary No. 63 March 2012, accessed via <http://bnf.org/bnf> 18/06/2012
6. Medicines for Children, Royal College of Paediatrics & Child Health 2003
 - a) British National Formulary for Children 2011-2012 accessed via <http://bnfc.org/bnfc> on 18/06/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer - not available
9. Drug company name: Boehringer Ingelheim. Date contacted: 13/04/2012

Version 5 (NHS Lothian local amendment)

Intravenous

Amikacin

MEDICINE NAME:

Amikacin

TRADE NAME(S):

Amikacin (Hospira UK Ltd)
Amikin®

PRESENTATION OF MEDICINE:

Vials containing amikacin 100mg in 2mL (as sulphate) solution for injection (Amikin®).^(1b)
Vials containing amikacin 500mg in 2mL (as sulphate) solution for injection (Hospira).^(1a)

METHOD OF ADMINISTRATION:

IV Infusion (usual method of administration):

Adults and paediatric patients: Administer required dose, appropriately diluted, using an infusion pump over either 30 or 60 minutes (according to local guidelines).^(1a-b)

Infants: Administer over 1 to 2 hours for infants.^(1a-b)

IV injection: Administer by slow IV injection over 2 to 3 minutes ^{(1a)(1b)}

Administer via a central venous access device if one is available to avoid potential venous irritation as the preparation has a low pH.⁽¹¹⁾ If a central venous access device is unavailable a risk benefit analysis should be made on an individual patient basis. If given peripherally, the insertion site must be monitored closely for phlebitis using a recognised infusion phlebitis scoring tool.⁽¹¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion:

Adults: Usual practice is to dilute the required dose in 100mL sodium chloride 0.9% or glucose 5%. However the manufacturers recommend diluting the required dose to a concentration of 2.5mg in 1mL with sodium chloride 0.9% or glucose 5%.^(1a)

Paediatric patients: The volume of infusion fluid should be sufficient to allow the appropriate infusion period.⁽³⁾⁽⁴⁾

IV injection:

100mg in 2mL preparation can be given undiluted, or diluted with 10-20mL sodium chloride 0.9% or glucose 5% to aid slow administration.

Due to extreme osmolarity of the 500mg in 2mL preparation always dilute dose before administration.

Amikacin solution may darken from colourless to pale yellow but this does not indicate loss of potency.^{(1a)(2)(4)}

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

24 hours.^(1a)

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Therapeutic drug level monitoring required. Ensure adequate hydration and monitor renal function to avoid nephrotoxicity.^(1a-b)

Amikacin (Hospira) and Amikin® injections contain sulphites which can cause allergic-type reactions, including anaphylactic symptoms and bronchospasm, in susceptible people, especially those with a history of asthma or allergy.^(1a-c)

Administration related adverse effects include tinnitus, deafness, vertigo, paraesthesia, nausea and vomiting.^(1a-b)

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to the low pH of the injection. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give amikacin by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

Amikacin infusion is compatible with the following infusions (it is assumed that the infusions mix close to the vascular access device): Sodium chloride 0.45% and glucose 2.5%, sodium chloride 0.45% and glucose 5%, sodium chloride 0.9% and glucose 5%, sodium chloride 0.9% and glucose 10%, glucose 10%, Ringer's solution and Hartmann's solution.⁽⁴⁾

Incompatible: Amphotericin, some beta-lactam antibiotics (penicillins and cephalosporins),^{(1a)(4)} erythromycin, heparin, phenytoin,^{(1a)(4)} propofol,⁽⁴⁾ thiopental.⁽⁴⁾

Amikacin activity may be impaired by beta-lactam antibiotics. However amikacin may be used with penicillins and cephalosporins but the injections should be given at separate sites.⁽⁴⁾

SODIUM CONTENT (mmol):

Less than 0.5mmol per 100mg vial and 0.56mmol per 500mg vial.⁽⁵⁾

OSMOLARITY / OSMOLALITY:

500mg in 100mL sodium chloride 0.9% - 349mOsm/L.^{(4)(9a)}

500mg in 100mL glucose 5% - 319mOsm/L.^{(4)(9a)}

pH:

Undiluted 500mg vial: 3.5 to 5.5.^{(4)(9b)(11)}

Undiluted 100mg vial: 4.2 to 4.8.^(9a)

OTHER COMMENTS:

1. Amikacin (Hospira) injection contains sodium citrate and sodium metabisulphite;^(1a)
Amikin® injection contains sodium bisulphite, sodium citrate and sulphuric acid.^(1b)
2. Store unopened vials below 25°C.^(1a-b)

OTHER INJECTABLE ROUTES OF ADMINISTRATION:

IM injection.^(1a-b)

Intrathecal injection (unlicensed).⁽³⁾

Intraventricular injection (unlicensed).⁽³⁾

REFERENCES:

1. Summary of Product Characteristics.
 - a) Amikacin - Hospira UK Ltd. Last revised 10/08/2012
 - b) Amikin® - Bristol Myers Pharmaceuticals. Last revised January 2012
 - c) Prescribing information. Amikacin sulphate injection USP - Hospira USA. Last revised April 2004
2. Martindale. Accessed via <http://www.medicinescomplete.com> on 07/06/2011. Last revised 26/02/2011
3. American Hospital Formulary Service Drug Information. Accessed via <http://www.medicinescomplete.com> on 07/06/2011. May 2011 Update
4. Trissel 'Handbook on Injectable Drugs'. Accessed via <http://www.medicinescomplete.com> on 10/06/2011
5. British National Formulary No. 61, March 2011, p351
6. Medicines for Children. Royal College of Paediatrics and Child Health. 2003
 - 6a) British National Formulary for Children, 2010-2011, p341-2
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8.
 - a) COSHH data sheet. Bristol-Myers Squibb Pharmaceuticals. Last revised 18/08/2010
 - b) COSHH data sheet. Hospira UK Ltd. Last revised 02/2010
9.
 - a) Drug company: Bristol-Myers Squibb. Date contacted: 10th August 2011
 - b) Drug company: Hospira UK Ltd. Date contacted: 10th August 2011
10. Personal communication from David Erskine, Director of London & South East Regional Medicines Information Service Pharmacy Department, Guys Hospital, GSTUFT, 09/04/2010.
11. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Intravenous

Aminophylline

There is an increased risk of toxicity if aminophylline/theophylline is administered simultaneously by more than one route

Martindale product has been discontinued. The last batch number is 1250965 with expiry date 31/12/2013

MEDICINE NAME:

TRADE NAME(S):

Aminophylline Aminophylline (hameln Pharmaceuticals Ltd) (Goldshield plc) (Cardinal Health, Martindale Pharma)

PRESENTATION OF MEDICINE:

Ampoules containing 250mg in 10mL ^{(1a-c)(5)}

METHOD OF ADMINISTRATION:

Loading dose: Administer loading dose in 100mL of suitable diluent. Administer over at least 20 minutes. ^{(1a-c)(5)} Rate not to exceed 25mg per minute. ^{(1b)(2)}

Maintenance dose: Dilute to 1mg in 1mL and administer by continuous infusion. The initial dose for adults should not exceed 500-700micrograms/kg/hour. ^{(1a-c)(5)}

The rate and duration of the maintenance infusion should be adjusted according to theophylline level and individual patient requirement. ^{(1b)(1c)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Loading dose: Dilute dose to 100mL with sodium chloride 0.9% or glucose 5%.

Maintenance infusion: Dilute to aminophylline 1mg in 1mL with sodium chloride 0.9% or glucose 5%.

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

24 hours when prepared in the clinical area ^{(4)(9a)}

EXAMPLE CALCULATION:

LOADING DOSE INFUSION RATE

To give the loading dose diluted to 100mL over 20 minutes, the infusion rate required is 300mL/hour.

N.B. loading doses in excess of 500mg will need to be administered at a slower rate to ensure that the recommended maximum rate of 25mg/minute is not exceeded.

MAINTENANCE DOSE INFUSION RATE

The infusion rate to set the infusion pump can be calculated from the following equation:

$$\text{Aminophylline infusion rate (mL/hour)} = \frac{\text{Dose (micrograms/kg/hour)} \times \text{patient weight (kg)}}{1,000 \times \text{Concentration (mg/mL)}}$$

For example: To administer a dose of 500micrograms/kg/hour of aminophylline to a 70kg patient using a solution of 1mg in 1mL, the calculation would look as follows:-

$$\text{Aminophylline infusion rate} = \frac{500 \text{ (micrograms/kg/hour)} \times 70 \text{ (kg)}}{1,000 \times 1 \text{ (mg/mL)}} = 35 \text{ mL/hour}$$

N.B. Infusion pumps can only be set to one decimal place. If the calculation produces a figure to two decimal places when setting the infusion pump, figures of 0.05 and above should be rounded UP to the next decimal place and figures below 0.05 should be rounded DOWN eg. 2.33mL/hour should be rounded down to 2.3mL/hour.

FLUSHING:

Sodium chloride 0.9%⁽⁴⁾⁽¹⁰⁾ or glucose 5%.⁽⁴⁾⁽⁹⁾⁽¹⁰⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

The drug has a narrow therapeutic index and serum levels should be monitored regularly.^{(1b)(1c)} During regular therapy serum potassium levels must be monitored (may cause hypokalaemia).^(1a-c)

Rapid administration may be associated with a lowering of blood pressure, headache, anxiety, insomnia, cardiac arrhythmias, convulsions and sudden death.^(1a-c) Severe toxicity may occur without preceding symptoms.^(1b)

If toxicity or overdose is suspected refer to Toxbase.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Solutions of aminophylline are alkaline and if the pH falls below 8, crystals of theophylline will deposit.⁽²⁾ Drugs known to be unstable in alkaline solutions should not be mixed with aminophylline, nor should drugs that will lower pH below the critical value.⁽²⁾

Compatible (it is assumed that medicines meet close to the vascular access device):

Ceftazidime,⁽⁴⁾ dexamethasone,⁽⁴⁾ dopamine,⁽⁴⁾ erythromycin lactobionate,⁽⁴⁾ furosemide,⁽⁴⁾ heparin,⁽⁴⁾ hydrocortisone sodium succinate,⁽⁴⁾ lidocaine (lignocaine),⁽⁴⁾ meropenem,⁽⁴⁾ ranitidine,⁽⁴⁾ piperacillin/tazobactam,⁽⁴⁾ remifentanyl,⁽⁴⁾ glucose 10%,⁽⁴⁾ glucose and sodium chloride combinations⁽⁴⁾ and compound sodium lactate (Hartmann's).⁽¹⁾⁽⁴⁾⁽⁵⁾

Incompatible: Amiodarone,⁽⁴⁾ ciprofloxacin,⁽⁴⁾ clarithromycin,⁽⁴⁾ dobutamine.⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

None^(9a)

SODIUM CONTENT (mmol):

Nil^{(9a)(9b)}

OSMOLARITY / OSMOLALITY:

Injection: Osmolarity - 170mOsm/L⁽¹¹⁾

Osmolality - 114mOsm/kg⁽⁴⁾

250mg in 50/100mL of glucose 5% = Osmolality 300/291mOsm/kg.⁽⁴⁾⁽¹¹⁾

250mg in 50/100mL of sodium chloride 0.9% = Osmolality 327/318mOsm/kg.⁽⁴⁾⁽¹¹⁾

pH:

Aminophylline 250mg in 10mL: pH 8.8 to 10.0 ^{(9a)(9b)}

Aminophylline 1mg in 1mL: pH 9.0 to 9.2 ⁽¹²⁾. See link.

OTHER COMMENTS:

1. Discard if the contents are discoloured. ^(1b)
2. Do not store above 25°C. ^(1b)

OTHER INJECTABLE ROUTES OF ADMINISTRATION:

500mg in 2mL preparation available for Intramuscular use only. This route is generally considered too irritant/painful

REFERENCES:

1. Summary of Product Characteristics
 - a) hameln Pharmaceuticals plc, last updated 06/07/2010
 - b) Goldshield plc, last revised 04/08/2009
 - c) Martindale Pharmaceuticals, November 2004
2. Martindale accessed via <http://www.medicinescomplete.com> on 17/06/2010
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 30/07/2010
4. Trissel "Handbook on Injectable Drugs" accessed via <http://www.medicinescomplete.com> on 22/07/2010
5. British National Formulary Edition 59 pgs 173-74 & 863
6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003
 - a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
9.
 - a) Drug company name: Cardinal Health, Martindale Pharma
Date contacted: 22/07/2010
 - b) Drug company name: hameln Pharmaceuticals
Date contacted: 22/07/2010
10. UCL Hospitals Injectable Drug Administration Guide, Second Edition 2007, pg 50
11. Accessibility by Bard, appendix 1: Drug information accessed via www.accessability-by-bard.co.uk
12. Quality Assurance Department, Charing Cross Hospital July11

Intravenous

Amiodarone hydrochloride

MEDICINE NAME:

Amiodarone
hydrochloride

TRADE NAME(S):

Generic - Cardinal Health,^(1b) Cordarone X Intravenous®^(1a)
OI Sciences,^(1c) UCB Pharma^(1d)

PRESENTATION OF MEDICINE:

Ampoules containing amiodarone 50mg in 1mL (as hydrochloride); 150mg in 3mL^{(1a)(c)}
Ampoules containing amiodarone 30mg in 1mL (as hydrochloride); 300mg in 10mL^(1b)
Pre-filled syringes containing amiodarone 30mg in 1mL (as hydrochloride); 300mg in 10mL^(1d)

METHOD OF ADMINISTRATION:

IV infusion (loading dose): Administer the required dose (usually 300mg)⁽¹⁵⁾ over 20 minutes to 2 hours using an infusion pump.^(1a-c)

Continuation infusion: The loading dose infusion may be followed by a repeat infusion using an infusion pump.^(1a-c) The total dose in any 24 hour period is up to 1200mg per 24 hours. The infusion rate is adjusted according to clinical response.^(1a-c)

Common practice is to give a 300mg loading dose infusion over one hour, followed by an infusion of 900mg over 23 hours.

Due to the low pH of amiodarone, concentrations exceeding amiodarone 2mg in 1mL should always be administered via a central venous access device.⁽²⁾⁽³⁾⁽⁴⁾ A central venous access device is also preferred, for any concentration, where repeated or continuous infusions are required.^(1a-d)

IV injection (extreme clinical emergency only): Administer 300mg in 10 to 20mL glucose 5% over a minimum of 3 minutes, preferably 10 to 20 minutes. Do not repeat for at least 15 minutes.^{(1a-c)(11)}

Preferably administer via central venous access device. If unavailable use a vein located as centrally as possible (external jugular or antecubital vein).⁽¹²⁾

If a peripheral line is used ensure that the line is patent before administration of the amiodarone (e.g. successful administration of other drugs or prior administration of sodium chloride 0.9%.^(1b)). If this route used then should be given (as a minimum) through a grey venflon from the antecubital fossa. A pink venflon in the dorsum of the hand is **unacceptable**.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion (loading dose):

Central administration: Dilute 300mg amiodarone to 50mL with glucose 5%.⁽¹⁵⁾

Peripheral administration: Dilute 300mg amiodarone to 250mL^(1a-d) with glucose 5%

Continuation infusion:

Central administration: Dilute each 300mg amiodarone to 50mL with glucose 5%.⁽¹⁵⁾ For doses greater than 300mg multiples of these syringes may be used. E.g for a 900mg dose use 3 x (300mg in 50mL).

Peripheral administration: Add the required dose to 500mL glucose 5%. E.g. 900mg in 500mL glucose 5%.⁽¹⁵⁾

Do not over-dilute. Solutions containing less than 300mg amiodarone in 500mL (i.e. less than 600micrograms per mL) are unstable and should not be used.^(1a-c)

IV injection (extreme clinical emergency): Preferably use the 300mg in 10mL preparation (pre-filled syringe or ampoule) without further diluting.⁽¹¹⁾ If a 300mg in 10mL preparation is unavailable the 150mg in 3mL preparation can be used. Preferably dilute dose to 10mL with glucose 5% however 300mg in 6mL can be used without further dilution if necessary.⁽¹²⁾⁽¹³⁾⁽¹⁴⁾

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

Prepare immediately before use. Discard any remaining infusion within 24 hours ^{(1a)(1b)(9c)}

FLUSHING:

IV infusion via a central venous access device: Do not flush the central venous access device. After the infusion is discontinued, disconnect the administration set, aspirate the cannula contents and then flush with sodium chloride 0.9%.

IV infusion via peripheral cannula: Flush the cannula with glucose 5% at the same speed as the rate of infusion to avoid adverse haemodynamic effects.^(1a-d)

IV injection: Flush with 10mL of glucose 5%, preferably^(1a-c) but sodium chloride 0.9%⁽¹³⁾⁽¹⁴⁾ can be used if necessary.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:**Adverse effects:**

Severe hypotension may follow intravenous use, particularly (though not exclusively) at rapid infusion rates.⁽²⁾

Rapid administration is also associated with anaphylactic shock, hot flushes, sweating and nausea.^{(1c)(1d)(2)}

Bradycardia can occur and for patients with a known predisposition to bradycardia and AV block, access to a temporary pacemaker should be available. Amiodarone may worsen existing arrhythmias or cause new ones, including QT prolongation. However, the proarrhythmogenic effects of amiodarone are generally considered to be low.⁽²⁾⁽³⁾ The risk of arrhythmogenic effects may be increased by concomitant use of other antiarrhythmic drugs (e.g. digoxin) and hypokalaemia.^{(1c)(3)} Electrolyte disturbances should be corrected before an amiodarone infusion is commenced.⁽²⁾

Severe hepatocellular toxicity, occurring within 24 hours of initiation, has been linked with intravenous amiodarone.^{(1a)(2)(5)} Serum transaminases should be monitored carefully.

Local injection site reactions include pain, erythema, oedema, necrosis, inflammation, thrombophlebitis, phlebitis, cellulitis, and pigmentation changes.^{(1a)(3)}

Monitoring:

During administration of intravenous amiodarone, blood pressure and ECG should be monitored. There should also be facilities available for defibrillation and cardiac pacing.^{(1a-d)(3)}

EXTRAVASATION:

Amiodarone should be administered via a central line when possible. Repeated or continuous infusion via peripheral veins may lead to injection site reactions. Extravasation will cause tissue damage due to the low pH of amiodarone. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive, or sodium chloride 0.9%, without first stopping the running infusion and flushing the line both before and after administering the injection.

Compatible (it is assumed that medicines meet in the administration set close to the cannula insertion site):

Adrenaline, amikacin, atracurium, calcium gluconate, ciprofloxacin, clarithromycin, dobutamine, dopamine, erythromycin, gentamicin, glyceryl trinitrate, insulin, midazolam, milrinone, morphine, noradrenaline, potassium chloride infusion, vancomycin.⁽⁴⁾ N.B. these medicines should not be diluted in sodium chloride 0.9% as amiodarone is incompatible with it.

Incompatible:

Conflicting stability data for amiodarone and sodium chloride 0.9% is available,⁽⁴⁾ and as a result the combination is usually stated as incompatible. When amiodarone is used in an emergency situation sodium chloride 0.9% is generally used as the flush solution and there have been no reported problems.

Amiodarone is incompatible with aminophylline, digoxin, drotrecogin alfa, furosemide, heparin, sodium bicarbonate, imipenem/cilastatin sodium, magnesium sulphate, piperacillin/tazobactam sodium, phosphate solutions.⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

None ⁽⁸⁾

SODIUM CONTENT (mmol):

Nil ^{(9a)(9b)(9d)}

OSMOLARITY / OSMOLALITY:

50mg/ml (ampoule as received) = 147mOsmol ^(9c)

300mg in 10ml glucose 5% = 239 mOsmol ^(9c)

300mg in 50ml glucose 5% = 282 mOsmol ^(9c)

900mg in glucose 5% = 283 mOsmol ^(9c)

pH:

3 to 5 ^{(9a)(9b)(9d)}

3.5 to 6.5 in glucose ^(9a)

See link.

OTHER COMMENTS:

1. Amiodarone can be administered by a syringe pump or a volumetric infusion pump. Additives in the amiodarone concentrate reduce the drop size leading to under dosing

if a drop counter infusion set is used, these infusion sets are therefore unsuitable.⁽²⁾⁽³⁾⁽⁴⁾

2. Formulation contains benzyl alcohol which can cause toxic reactions in infants and children up to the age of 3 years.^{(1a)(2)(3)(6)(6a)}
3. One 150mg ampoule contains 56mg iodine^(1a) and one 300mg vial contains 112mg iodine.^(1d)
4. It is recommended that amiodarone dilution for infusion is administered through a non-DEHP (component of PVC) containing administration set.^(1a-d) This is to minimise patient exposure to DEHP, which may leach out of the administration set on exposure to amiodarone. However, the clinical significance of this is uncertain.
5. March 2011 - The SPC has been revised since this monograph was last updated
6. April 2011 - The SPC has been revised since this monograph was last updated

REFERENCES:

1. Summary of Product Characteristics
 - a) Cordarone X Intravenous, Sanofi Aventis, last revised 07/05/2009
 - b) Amiodarone Injection, Cardinal Health, last revised, March 2005
 - c) Amiodarone Injection, OI Sciences Ltd, last revised 16/01/2009
 - d) Amiodarone Injection Minijet, UCB Pharma (IMS UK Ltd), last revised 31/03/2008
2. Martindale accessed via <http://www.medicinescomplete.com/mc/> on 19/03/2010
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com/mc/> on 19/03/2010
4. Trissel " Handbook on injectable drugs" 15th Edition pg 109-115
5. British National Formulary No 59 (March 2010)
6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003
 - a) British National Formulary for Children 2009 pg 109, 111
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
9. a) Drug company name: Sanofi-Aventis
Date contacted: 27/09/2007
 - b) Drug company name: UCB Pharma
Date contacted: 27/09/2007
 - c) Drug company name: OI Sciences Ltd
Date contacted: 02/10/2009
10. Borthwick M, Woods J, Keeling S et al. A survey to inform standardization of intravenous medication concentrations in critical care. J Intensive Care Soc 2007;8(1):92-96
11. Resuscitation Council (UK) Website www.resus.org.uk
12. The use of undiluted amiodarone in the management of out-of-hospital cardiac arrest, M. B. SKRIFVARS et al; Acta Anaesthesiol Scand 2004; 48: 582-587. [Link](#)
13. Administration of amiodarone during resuscitation of ventricular arrhythmias; Heather D. Eppert, PharmD, BCPS, and Kara B. Goddard, BS; Journal of emergency nursing; Volume 36, January 2010. [Link](#)
14. Intravenous amiodarone for ventricular arrhythmias: overview and clinical use; Edgar R. Gonzalez a, Barbara S. Kannewurf b, Joseph P. Ornato; Resuscitation 39 (1998)

- 33–42. [Link](#)
15. Standard concentrations for infusions used in critical care areas. The Intensive Care Society supports the adoption of standard concentrations. For details, go to the Intensive Care society website and see 'Medication Concentrations in Critical Care Areas (2010)' [See Link](#)

Version 3 (NHS Lothian Local amendment)

Intravenous

Amoxicillin (amoxycillin)

Contains a PENICILLIN.

MEDICINE NAME:

Amoxicillin (amoxycillin)

TRADE NAME(S):

Amoxil® (GlaxoSmithKline UK)
Amoxicillin (Wockhardt UK Ltd, Bowmed IbisqusLtd)

PRESENTATION OF MEDICINE:

Vials containing amoxicillin 250mg powder for reconstitution (as sodium salt).^(1b-c)
Vials containing amoxicillin 500mg powder for reconstitution (as sodium salt).^(1a-c)
Vials containing amoxicillin 1g powder for reconstitution (as sodium salt).^(1a-c)

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3-4 minutes ^(1a-c)

IV infusion: Administer over 30-60 minutes. ^(1a-c)

In children and neonates, give by IV infusion over 30 minutes when dose is greater than 30mg/kg. ^{(6a)(10)}

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a high pH.⁽¹¹⁾ If a central venous access device is unavailable a risk benefit analysis should be made on an individual patient basis. If given via a peripheral venous catheter, it is preferable to dilute to 100mL in sodium chloride 0.9% and give by infusion (as described below) as pH of this solution is known to be less than 9.⁽¹⁴⁾

INSTRUCTIONS FOR RECONSTITUTION:

Adults:

250mg vials, reconstitute with 5mL water for injections to give 48mg/mL. ^(1b-c)
500mg vials, reconstitute with 10mL water for injections to give 48mg/mL. ^(1a-c)
1g vials, reconstitute with 20mL water for injections to give 48mg/mL. ^(1a-c)

Children:

250mg vial, reconstitute with 4.8mL water for injections to give 50mg/mL. ^{(4)(6)(6a)}
500mg vial, reconstitute with 9.6mL water for injections to give 50mg/mL. ^{(6)(6a)}
1g vial, reconstitute with 19.2mL water for injections to give 50mg/mL. ^{(6)(6a)}

Neonates:

250mg vial, reconstitute with 2.3mL water for injections to give 100mg/mL. ^{(6a)(10)}
500mg vial, reconstitute with 4.6mL water for injections to give 100mg/mL. ^{(4)(6)(6a)}

Shake until solution is clear and then withdraw the required volume from the vial into a syringe.

Requires further dilution before administration by IV infusion (see below). ^(1a-c)

Reconstituted solutions are normally a pale straw colour; however, a transient pink colour or slight opalescence may appear during reconstitution. ^{(1a)(1c)}

DISPLACEMENT VALUE:

250mg displaces 0.2mL. ^(1b-c)
500mg displaces 0.4mL. ^(1a-c)
1g displaces 0.8mL. ^(1a-c)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: add the required volume of the reconstituted solution to 100mL sodium chloride 0.9% (preferred) or glucose 5%.^{(1c)(5)(6a)(12)} This may be in the form of a mini-bag or in-line burette.^{(1a-c)(4)}

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

Prepare immediately before administration.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Anaphylaxis and other hypersensitivity reactions (sometimes fatal).^(1a-c) **Monitoring:** monitor for rashes and other skin reactions, urticaria, fever, joint pains, angioedema and anaphylaxis.⁽²⁾⁽³⁾⁽⁵⁾
2. Convulsions in patients with impaired renal function or receiving high doses.^(1a-c)
3. Patients with syphilis and other spirochaete infections may experience a Jarisch-Herxheimer reaction shortly after treatment is started. Can be dangerous in cardiovascular syphilis, or where there is a serious risk of increased local damage, such as with optic atrophy. **Monitoring:** symptoms include fever, chills, headache and reaction at the site of lesions.^{(1b)(2)}

EXTRAVASATION:

No information available.^(9a-c)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

Compatible (it is assumed that medicines meet in the administration set close to the cannula insertion site): No information.^(1a-c)

Incompatible: Aminoglycosides (e.g. gentamicin, tobramycin, amikacin), ciprofloxacin, midazolam, sodium bicarbonate.^{(1a-c)(4)}

Amoxicillin should not be mixed with blood products, other proteinaceous fluids such as protein hydrolysates, or with intravenous lipid emulsions.^(1a-c)

Compatible with the following infusion fluids: Compound sodium lactate (Hartmann's), glucose 10%, potassium chloride 0.3% and sodium chloride 0.9%, sodium chloride 0.18% and glucose 4%, sodium chloride 0.45%, sodium lactate M/6.^{(1c)(6)(6a)}

The manufacturer recommends water for injections as a suitable intravenous infusion fluid, however, it is rarely used in practice as it is likely to cause hyponatraemia.^(1c)

SPECIAL HANDLING PRECAUTIONS:

Contact with amoxicillin should be avoided since skin sensitisation may occur.^(1b)

SODIUM CONTENT (mmol):

250mg vial: 0.65-0.8mmol sodium.^{(1b)(1c)}

500mg vial: 1.3-1.7mmol sodium.^(1a-c)

1g vial: 2.6-3.3mmol sodium.^(1a-c)

OSMOLARITY / OSMOLALITY:

Reconstituted as above for adults to a concentration of 48mg/mL; 245mOsmol/L^(9c)

The following three figures are theoretical osmolarities calculated using the molecular concentration method:⁽¹³⁾

1g amoxicillin reconstituted as above for adults and then diluted in 100mL sodium chloride

0.9%: 297mOsmol/L (based on osmolarity of reconstituted solution provided by manufacturer).

Reconstituted as above for children to a concentration of 50mg/mL: 274mOsmol/L

Reconstituted as above for neonates to a concentration of 100mg/mL: 547mOsmol/L

pH:

100mg/mL solution in water for injections: pH 8-10 (Bowmed Ibisqus Ltd and Wockhardt).^{(9b)(9c)}

1g amoxicillin (Amoxil®) in 100mL sodium chloride 0.9%: pH 8.8.⁽¹⁴⁾

OTHER COMMENTS:

1. Store the unreconstituted product below 25°C in a dry place protected from light.^{(1a-c)(4)}
2. Maintain adequate hydration and urinary output when high doses of amoxicillin are used, in order to reduce the risk of amoxicillin crystalluria.^(1a-c)
3. The vials are not suitable for multidose use.^(1b)

REFERENCES:

1. Summary of Product Characteristics
 - a) Amoxil® vials for Injection, 500mg and 1g strengths (GlaxoSmithKline UK). Last revised January 2012
 - b) Amoxicillin Sodium for Injection (Wockhardt UK Ltd). Last revised June 2010.
 - c) Amoxicillin Powder for Solution for Injection or Infusion, 250mg, 500mg and 1g strengths (MAH: Bowmed Ltd; distributed by Bowmed Ibisqus Ltd). Last revised 17/12/2010
2. Martindale accessed via <http://www.medicinescomplete.com> on 30/03/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 02/04/2012
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 02/04/2012
5. British National Formulary No. 63 accessed via www.bnf.org on 02/04/2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - 6a) BNF for Children 2011-12 accessed via www.bnfc.org on 03/04/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
 - a) GlaxoSmithKline UK, last revised 19/06/2006

- b) Wockhardt UK Ltd, printed April 2010
- c) Bowmed Ibisqus Ltd, last revised September 2008
- 9. a) Drug company name: Glaxo SmithKline UK. Date contacted: 03/04/2012 and 05/04/2012 but refused to provide information
- b) Drug company name: Bowmed Ibisqus Ltd. Date contacted: 05/04/2012
- c) Drug company name: Wockhardt UK Ltd. Date contacted: 03/04/2012
- 10. Western Neonatal Network Prescribing Group Amoxicillin Intravenous monograph. Last updated September 2008
- 11. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
- 12. Package Information Leaflet: Information for the Healthcare Professional for Amoxil vials for injection 500mg and 1g. Last revised December 2007
- 13. Langfield et al., 2010. Avoiding osmotic imbalances. British Journal of Clinical Pharmacy, 2, pp. 307-308.
- 14. Quality Assurance, Pharmacy Department, Charing Cross Hospital, Date contacted: 19/4/2012.

Version 4

Intravenous

Amphotericin, liposomal (AmBisome)

There are three different formulations of intravenous amphotericin and they are not interchangeable.

Check carefully that the product that is administered is the formulation that was prescribed.⁽⁵⁾

MEDICINE NAME:

Amphotericin, liposomal
(amphotericin B, liposomal)

TRADE NAME(S):

AmBisome® (Gilead)

PRESENTATION OF MEDICINE:

Vials containing 50mg amphotericin (50,000 units) encapsulated in liposomes. Powder for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION:

IV infusion: over 30 to 60 minutes⁽¹⁾⁽²⁾⁽⁵⁾ using an infusion pump.

Test dose: A test dose of 1mg for adults (or 100micrograms/kg, maximum 1mg for children 1month-18years old)^(6a) must be administered before giving the first dose of each course of treatment.⁽¹⁾⁽²⁾⁽⁵⁾ **A test dose can be given in two ways:**

EITHER

Administer an initial test dose over 10 minutes directly from the prepared amphotericin, liposomal (AmBisome®) infusion; stop the infusion and observe the patient carefully for the next 30 minutes.

OR

Withdraw a volume containing the test dose from the prepared amphotericin, liposomal (AmBisome®) infusion and give over 10 minutes via a syringe pump. Observe the patient carefully for the next 30 minutes.

If 30 minutes after the administration of the test dose there is no severe allergic or anaphylactic reaction, give the rest of the infusion over 30 to 60 minutes. The infusion should be stopped immediately if severe allergic reaction occurs at any point during administration. If a minor allergic reaction occurs, further advice should be sought from medical staff.

For patients who experience discomfort during the infusion or for doses greater than 5mg/kg, giving the infusion more slowly, i.e. over 2 hours is recommended.⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Add 12mL water for injections to each vial to give a preparation containing 4mg amphotericin, liposomal (AmBisome®) in 1mL.⁽¹⁾⁽⁴⁾⁽⁵⁾ Shake the vial vigorously for 30 seconds in order to disperse the powder.⁽¹⁾⁽⁴⁾⁽⁵⁾ Visually inspect the vial for particulate matter and continue shaking until complete dispersion is obtained.⁽¹⁾ This preparation requires further dilution before administration.

DISPLACEMENT VALUE:

Addition of 12mL to 50mg vial results in a concentration of amphotericin, liposomal (AmBisome®) 4mg in 1mL.⁽¹⁾ Therefore displacement value is 0.5mL.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Withdraw the required dose from the reconstituted vial(s) and add it to glucose 5% using the 5 micron filter provided. Amphotericin, liposomal (AmBisome®) must be diluted with glucose 5% to produce a final concentration of 0.2mg (200micrograms) to 2mg per 1mL.⁽¹⁾⁽⁵⁾

The volume of glucose 5% for the final infusion will also depend on the individual fluid requirements.

For example doses of less than 100mg per day can be diluted with 100mL glucose 5%.

Doses between 100mg-500mg can be diluted with 250-500mL of glucose 5%.

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

24 hours.⁽¹⁾

EXAMPLE CALCULATION:

Typical dose range is 1mg/kg to 5mg/kg. Doses above 3mg/kg are not licensed.⁽¹⁾ The 'links' section below details the dose of amphotericin, liposomal required for different patient weights to be added to glucose 5% to prepare an infusion.

An example of a calculation to determine the volume of glucose 5% required to prepare an infusion for a patient weighing 60kg on a dose of 1mg/kg daily dose of amphotericin, liposomal (AmBisome®) is as follows:

Dose: 60mg

$$\text{Volume of 4mg in 1mL concentrate required} = \frac{60\text{mg} \times 1\text{mL}}{4\text{mg}} = 15\text{mL}$$

Concentration of infusion must be between 0.2mg (200micrograms) and 2mg per mL.

$$\text{Maximum volume for dilution (mL)} = \frac{\text{Dose (mg)}}{0.2\text{mg/mL}}$$

$$\text{Minimum volume for dilution (mL)} = \frac{\text{Dose (mg)}}{2\text{mg/mL}}$$

i.e. for a 60mg dose

$$\text{Maximum volume for dilution (mL)} = \frac{60\text{mg}}{0.2\text{mg/mL}} = 300\text{mL}$$

$$\text{Minimum volume for dilution (mL)} = \frac{60\text{mg}}{2\text{mg/mL}} = 30\text{mL}$$

These volumes are not practical so choose a suitable volume somewhere between the two i.e. 100mL or 250mL glucose 5%.

Please note: An equal volume of diluent may need to be withdrawn from the infusion bag before adding the drug, otherwise the added volume must be considered when calculating

the final concentration of the infusion.

Calculation of volume to be withdrawn to administer as the test dose

Test dose: 1mg over 10minutes.

$$\text{Test dose volume (mL)} = \frac{\text{Test dose (mg)}}{\text{Infusion concentration (mg/mL)}}$$

So, if the final concentration is 60mg in 100mL, i.e. 0.6mg (600micrograms) per mL:

$$\text{Test dose volume (mL)} = \frac{1\text{mg}}{0.6\text{mg/mL}} = 1.7\text{mL}$$

So, to give a test dose of 1mg of the prepared amphotericin, liposomal (AmBisome®) infusion 60mg in 100mL of glucose 5%, administer 1.7mL of the infusion over 10minutes. If no anaphylactic reaction has occurred in the next 30 minutes, the rest of the infusion can be administered over 30 to 60 minutes.

FLUSHING:

Flush with glucose 5% only (note **DO NOT** use sodium chloride 0.9%).⁽¹⁾⁽⁵⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

If a severe allergic or anaphylactic reaction occurs, the infusion should be immediately discontinued and the patient should not receive further infusions of amphotericin, liposomal (AmBisome®) or other amphotericin-based preparations.⁽¹⁾

The most frequently reported infusion-related reactions associated with IV infusion of amphotericin, liposomal (AmBisome®) include fever, and chills/rigors.⁽¹⁾

Less frequent infusion-related reactions include one or more of the following symptoms back pain, chest tightness or pain, dyspnoea, bronchospasm, flushing, tachycardia and hypotension. These tend to resolve rapidly when the infusion is stopped and may not occur with subsequent doses.⁽¹⁾

Slower infusion rates (over 2 hours) or routine doses of diphenhydramine (chlorphenamine, another antihistamine agent available in the UK), paracetamol, pethidine, and/or hydrocortisone have been reported to be successful in the prevention or treatment of these adverse effects.⁽¹⁾

EXTRAVASATION:

Not known to be an irritant or vesicant.⁽¹⁰⁾ If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or infusion fluids.⁽¹⁾⁽²⁾⁽⁹⁾

Compatible diluent: Glucose 5%.

Incompatible: Sodium chloride solutions.

SPECIAL HANDLING PRECAUTIONS:

None.⁽⁸⁾

SODIUM CONTENT (mmol):

Approximately 7.0 mg per vial (or 0.3mmol per vial).⁽⁹⁾

OSMOLARITY / OSMOLALITY:

300-350mOsm/L (4mg/mL in water for injection).⁽⁹⁾

pH:

Amphotericin, liposomal (AmBisome®) reconstituted with water for injection (4mg/1mL) has a pH of 5 to 6.⁽³⁾⁽⁹⁾

OTHER COMMENTS:

1. Do not store unopened vials or infusion bags with diluted amphotericin, liposomal (AmBisome®) above 25°C. Do not freeze.⁽¹⁾
2. As there is no bacteriostatic agent in amphotericin, liposomal (AmBisome®),⁽¹⁾ from microbiological point of view the solution prepared for IV infusion should be used promptly after preparation.
3. Flush line with glucose 5% prior to infusion or use a separate line.⁽¹⁾⁽⁵⁾
4. 50mg vial contains approximately 900mg sucrose.⁽¹⁾
5. Do not store partially used vials for future patient use.⁽¹⁾
6. An in-line membrane filter may be used for intravenous infusion of amphotericin, liposomal (AmBisome®). However, the mean pore diameter of the filter should not be less than 1.0 micron.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, last revision of the text December 2011
2. Martindale "The Complete Drug Reference", accessed via www.medicinescomplete.com December 2012
3. American Hospital Formulary Service Drug Information, accessed via www.medicinescomplete.com in January 2012
4. Trissel "Handbook on injectable drugs", accessed via www.medicinescomplete.com in January 2012
5. British National Formulary No. 63, March 2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2011-2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Gilead Sciences Ltd, Date contacted: February 2012
10. The national extravasation information service' Accessed via www.extravasation.org.uk, accessed December 2011

Intravenous

Amphotericin, non-lipid (Fungizone)

There are three different formulations of intravenous amphotericin and they are not interchangeable.

Check carefully that the product that is administered is the formulation that was prescribed.

MEDICINE NAME:

TRADE NAME(S):

Amphotericin
(amphotericin B)

Fungizone 50mg Powder for Sterile Concentrate[®] (E. R. Squibb & Sons Limited)

PRESENTATION OF MEDICINE:

Vials containing amphotericin, non-lipid 50mg (50,000 units) powder for concentrate for solution for infusion⁽¹⁾ (as sodium deoxycholate complex).⁽²⁾⁽³⁾⁽⁵⁾

METHOD OF ADMINISTRATION:

IV infusion: over 2 to 4 hours at a maximum concentration of 100micrograms/mL (10mg/100mL) in glucose 5% using an infusion pump.⁽¹⁾⁽⁵⁾

Administration via a central venous access device is preferred route of administration. If this is not possible a large peripheral vein should be used.

Test dose: A test dose of 1mg for adults⁽¹⁾ (or 100micrograms/kg, maximum 1mg for children 1 month - 18 years old)^(6a) must be administered before giving the first dose of each course of treatment. **A test dose can be given in two ways:**

EITHER

Administer an initial test dose over 20-30 minutes directly from the prepared amphotericin, non-lipid (Fungizone[®]) infusion; stop the infusion and observe the patient carefully for at least further 30 minutes.

OR

Withdraw a volume containing the test dose from the prepared amphotericin, non-lipid (Fungizone[®]) infusion and give it over 20-30 minutes. Observe the patient carefully for at least further 30 minutes.

If 30 minutes after the administration of the test dose there is no severe allergic or anaphylactic reaction the rest of the infusion can then be administered over 2 to 4 hours.⁽¹⁾⁽²⁾⁽³⁾⁽⁵⁾

Slower infusion, over 6 hours may be necessary to reduce the incidence of acute infusion related adverse effects.⁽¹⁾

An in-line 5micron membrane filter may be used.

Concentrations of up to 500micrograms per 1mL (50mg in 100mL) have been given via a central venous access device over 6 hours but are not recommended by the manufacturers. However, the manufacturers are not aware of any specific adverse effects from administering higher concentrations.⁽¹⁰⁾

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute vial with 10mL **water for injections** to produce a concentration of 5mg in 1mL. Shake until colloidal solution is clear. **Do not reconstitute with sodium chloride 0.9%.**⁽¹⁾ This preparation requires further dilution before administration.

DISPLACEMENT VALUE:

Negligible.⁽⁶⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Withdraw the required dose from reconstituted vial and dilute it with glucose 5% to produce a maximum concentration of 100micrograms in 1mL.⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾

For example doses of up to 10mg can be diluted with 100mL glucose 5%. Doses of up to 25mg can be diluted with 250mL glucose 5%. Doses of up to 50mg can be diluted with 500mL glucose 5%.

The glucose 5% used must have a pH of 4.2 or higher to prevent precipitation. Add 1 or 2mL of phosphate buffer to the glucose 5% infusion bag **before** the amphotericin, non-lipid (Fungizone®) concentrate is added.⁽¹⁾

Approximately 1mL of phosphate buffer should be used to adjust the pH of every 250mL of glucose 5%.

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

Solutions prepared for IV infusion should be used promptly after preparation.⁽¹⁾

EXAMPLE CALCULATION:

Typical dose range is 250micrograms/kg to 1mg/kg.

An example for a calculation to determine the volume of 5% glucose required to prepare an infusion for a patient weighing 60kg on a dose of 250micrograms/kg/day amphotericin, non-lipid (Fungizone®) is as follows:

Dose: 15mg

Concentration of infusion must not exceed 100micrograms per mL (0.1mg per mL).

$$\text{Minimum volume for dilution (mL)} = \frac{\text{Dose (mg)}}{0.1\text{mg/mL}}$$

i.e. for a 15mg dose

$$\text{Minimum volume for dilution (mL)} = \frac{15\text{mg}}{0.1\text{mg/mL}} = 150\text{mL}$$

This is the minimum volume, in practice the volume can be rounded up to the nearest bag size i.e. 250mL.

Calculation of volume to be withdrawn to administer as a test dose

Test dose: 1mg over 20-30 minutes.

$$\text{Test dose volume (mL)} = \frac{\text{Test dose (mg)}}{\text{Infusion concentration (mg/mL)}}$$

So, if the final concentration is 15mg in 250mL i.e. 0.06mg (60micrograms) per mL:

$$\text{Test dose volume (mL)} = \frac{1\text{mg}}{0.06\text{mg/mL}} = 17\text{mL}$$

So, to give a test dose of 1mg of the prepared amphotericin, non-lipid (Fungizone®) infusion 15mg in 250mL glucose 5%, administer 17mL of the infusion over 20-30 minutes. If no anaphylactic reaction has occurred in the next 30 minutes, the rest of the infusion can be administered over 2 to 4 hours.

FLUSHING:

Flush with glucose 5%.⁽²⁾⁽⁵⁾

Incompatible with sodium chloride 0.9% ⁽²⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

If anaphylactoid reactions occur stop infusion and do not infuse amphotericin, non-lipid (Fungizone®) or other amphotericin-based preparation again.⁽¹⁾

Acute infusion reactions are common including fever (sometimes with shaking, chills), headache, anorexia, weight loss, nausea and vomiting, malaise, muscle and joint pains, dyspepsia, cramping epigastric pain, diarrhoea.⁽¹⁾

Avoid rapid infusion which increases incidence and severity of side effects, such as arrhythmias and hyperkalaemia.⁽¹⁾

May cause phlebitis, thrombophlebitis and pain at injection site.⁽¹⁾⁽⁵⁾

In patients who experience adverse reactions, the severity can be reduced by giving aspirin, antihistamines or anti-emetics. Febrile reactions may be decreased by IV administration of small doses of corticosteroids e.g. 25mg hydrocortisone, just prior to or during amphotericin infusion. Administering the drug on alternate days may decrease anorexia and phlebitis.⁽¹⁾

EXTRAVASATION:

Extravasation may cause chemical irritation⁽¹⁾ or tissue damage as amphotericin, non-lipid (Fungizone®) solutions irritate the venous endothelium.⁽²⁾ Administer via a central venous access device if possible. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet in the administration set close to the cannula insertion site): Amiodarone, heparin, hydrocortisone (as sodium succinate and sodium phosphate), tacrolimus.⁽⁴⁾

Incompatible: Sodium chloride, benzylpenicillin, calcium salts, ciprofloxacin, gentamicin, magnesium sulphate, ondansetron, potassium chloride, ranitidine, verapamil.⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

None.⁽⁸⁾

SODIUM CONTENT (mmol):

0.357mmol per vial.⁽¹⁰⁾

Less than 0.5mmol per vial.⁽⁵⁾

OSMOLARITY / OSMOLALITY:

54mOsm/kg in 10mL of water for injections.⁽¹⁰⁾

256mOsm/kg (0.1mg in 1mL in glucose 5%).⁽⁴⁾

pH:

Amphotericin, non-lipid (Fungizone®) 10mg in 100mL in glucose 5% has a pH of 5.7.⁽⁴⁾

OTHER COMMENTS:

1. Store vials at 2-8°C.⁽¹⁾
2. Under no circumstances should a total daily dose of 1.5mg/kg be exceeded.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, last revised 27 February 2010
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com in March 2012
3. American Hospital Formulary Service Drug Information, accessed via www.medicinescomplete.com in March 2012
4. Trissel "Handbook on injectable drugs", accessed via www.medicinescomplete.com in March 2012
5. British National Formulary No. 63, March 2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2011-12
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Raymond G, Davis RL. Physical compatibility and chemical stability of Amphotericin in combination with magnesium sulphate in 5% glucose. DICP Ann Pharmacol 1991;25(2):123-6
10. Drug company name: Bristol Myers Squibb Pharmaceuticals Ltd. Date contacted: April 2012

Version 6

Intravenous

Anidulafungin

MEDICINE NAME:

Anidulafungin

TRADE NAME(S):

ECALTA®

PRESENTATION OF MEDICINE:

Vial containing anidulafungin 100mg white to off-white powder. ⁽¹⁾

METHOD OF ADMINISTRATION:

For infusion only. ⁽¹⁾ Do not administer by a bolus injection. ⁽³⁾

Administer the infusion at a rate that does not exceed 1.1mg/minute, ⁽²⁾ equivalent to 1.4mL/minute of solution reconstituted and diluted as described below. ⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute the powder with 30mL water for injections to provide a concentration of 3.33mg in 1mL. Reconstitution may take up to 5 minutes. The reconstituted solution should be clear and free from visible particles. ⁽¹⁾

Requires further dilution before administration. ⁽¹⁾

DISPLACEMENT VALUE:

Negligible. ⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

The reconstituted solution must be further diluted with sodium chloride 0.9% or glucose 5% to produce a solution containing anidulafungin 0.77mg per 1mL. ⁽¹⁾

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

The diluted infusion must be used immediately after preparation.

EXAMPLE CALCULATION:

Dose	Number of boxes	Total Reconstituted volume	Infusion volume	Total Infusion volume	Infusion solution concentration	Rate of infusion
100mg	1	30mL (1 box)	100mL	130mL	0.77mg/mL	1.4mL/minute. Minimum duration of infusion: 90 minutes
200mg	2	60mL (2 boxes)	200mL	260mL	0.77mg/mL	1.4mL/minute. Minimum duration of infusion: 180 minutes

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5% ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Infusion site pain ⁽¹⁾

Infusion-related reactions; flushing/hot flushes, pruritis, rash, urticaria. ⁽¹⁾⁽⁹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines. ⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

None ⁽⁹⁾

SODIUM CONTENT (mmol):

Negligible. ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

In sodium chloride 0.9%: 251-252mOsmol/L

In glucose 5% 232-235mOsmol/L ⁽⁹⁾

pH:

Reconstituted solution pH of 3.5 to 5.5 ⁽¹⁾

OTHER COMMENTS:

1. Not licensed for children.
2. Patients with rare hereditary problems of fructose intolerance should not take this medication.
3. Store the original product at room temperature.

REFERENCES:

1. Summary of Product Characteristics, Ecalta® infusion, last updated 12/01/2010
2. Martindale "The Complete Drug Reference" Edition 36, pg 527.2
3. American Hospital Formulary Service Drug Information"
4. Trissel "Handbook on injectable drugs" Edition 15, pg 163
5. British National Formulary No. 59
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Pfizer Ltd
Date contacted: 10/07/08

Version 1 (NHS Lothian local amendment)

Intravenous

Artesunate

Unlicensed

MEDICINE NAME:

Artesunate

TRADE NAME(S):

Artesor®, Malartin®, Guilin Pharmaceutical Co. Ltd

PRESENTATION OF MEDICINE:

Vials containing artesunate 60mg powder for reconstitution with one ampoule (1mL) of 5% sodium bicarbonate solution.⁽⁹⁾

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection at a maximum rate of 3-4mL (30-40mg artesunate) per minute.⁽²⁾⁽⁹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute the contents of 60mg vial with 1ml sodium bicarbonate 5% solution, provided.⁽⁹⁾⁽¹¹⁾
Shake for 2-3 minutes before use.⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Dilute with 5ml of glucose 5% or sodium chloride 0.9% to make a maximum 10mg/mL concentration.⁽⁹⁾⁽¹¹⁾

It should not be administered if the solution appears cloudy or sediment occurs.⁽⁹⁾

STABILITY:

Prepare immediately before administration.

FLUSHING:

Glucose 5% or sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Bradycardia, first-degree atrioventricular block, monitor blood pressure.⁽¹¹⁾

Skin rash, pruritus, anaphylactic reactions requiring immediate treatment with antihistamines, steroids, or pressor agents.⁽²⁾⁽¹¹⁾

Headache, dizziness, tinnitus.⁽²⁾⁽¹¹⁾

Transient reticulocytopenia may occur when overdose of artesunate Injection (more than 3.75mg/kg) is given.⁽⁹⁾⁽¹¹⁾

EXTRAVASATION:

Artesunate has the potential to cause tissue injury if extravasation occurs, as the pH is less than 5⁽⁹⁾ and it has an osmolarity greater than 500mOsmol/L.⁽⁹⁾ If extravasation occurs refer to local treatment policies.⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

SODIUM CONTENT (mmol):

Nil (unreconstituted vial)⁽⁹⁾

OSMOLARITY / OSMOLALITY:

1572mOsm/L (when reconstituted with 1mL of sodium bicarbonate)⁽⁹⁾

pH:

3.5 to 4.5 ⁽⁹⁾

OTHER COMMENTS:

1. Contraindicated if prior hypersensitivity to artesunate/ dihydroartemisinin (main metabolite).⁽¹¹⁾
2. Intravenous artesunate is indicated for severe malaria in patients/areas with evidence of multidrug resistance (eg, quinine, mefloquine), and for patients with cerebral malaria. It is effective for malaria caused by chloroquine resistant strain of plasmodium falciparum.⁽⁹⁾⁽¹¹⁾
3. Store artesunate injection at room temperature, 15-30°C, protect from light.⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics
2. Martindale accessed via <http://www.medicinescomplete.com> March 2010
3. American Hospital Formulary Service Drug Information" accessed via <http://www.medicinescomplete.com> March 2010
4. Trissel "Handbook on injectable drugs" 15th Edition accessed via <http://www.medicinescomplete.com> March 2010
5. British National Formulary No. 58
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Canton Pharmaceuticals, Inc & Guilin Pharmaceutical Co.Ltd, Guilin, Guangxi, China
Date contacted: March 2010
10. www.extravasation.org.uk
11. MICROMEDEX 1.0 (Healthcare Series), February 05, 2010
12. Davis T, Hoang L et al: Pharmacokinetics and Pharmacodynamics of Intravenous Artesunate in Severe Falciparum Malaria. Antimicrob Agents Chemother. 2001 January; 45(1):181-186
13. Batty KT, Illett KF et al: Chemical stability of artesunate injection and proposal for its administration by intravenous infusion. J Pharm Pharmacol. 1996 Jan;48(1):22-6.

Version 1(NHS Lothian local amendment)

Intravenous

Aztreonam

Contains a PENICILLIN-like structure

MEDICINE NAME:

Aztreonam

TRADE NAME(S):

Azactam® ⁽¹⁾⁽²⁾

PRESENTATION OF MEDICINE:

Vials containing aztreonam 1g powder for reconstitution ⁽¹⁾

Vials containing aztreonam 2g powder for reconstitution ⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3-5 minutes. ⁽¹⁾

IV infusion: Infusion at concentrations not exceeding 20mg in 1mL should be completed within 20 to 60 minutes. ⁽¹⁾

Single doses over 1g should be administered by intravenous route only. ⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

IV injection: Add 6 to 10mL water for injections to vial. Shake immediately and vigorously. ⁽¹⁾

IV infusion: Add at least 3mL of water for injections for each 1 gram of aztreonam. Shake immediately and vigorously. Then further dilute (see below). ⁽¹⁾

DISPLACEMENT VALUE:

1g vial: add 9.1mL diluent to give 100mg in 1mL ⁽⁹⁾

2g vial: add 7.8mL diluent to give 200mg in 1mL ⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: The final concentration of infusion solution should not exceed 20mg in 1mL (i.e. at least 50mL of compatible diluent must be used for each 1 gram of aztreonam). ⁽¹⁾

Suitable diluents: Sodium chloride 0.9% ⁽¹⁾ or glucose 5% ⁽¹⁾

Depending on the type and amount of diluent, the colour may change from colourless to light straw-yellow, which may develop a slight pink tint on standing; however this does not affect the potency. ⁽¹⁾

STABILITY

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Phlebitis and/or thrombophlebitis have been reported in 2-3% of patients receiving IV aztreonam. ⁽³⁾

Phlebitis and thrombophlebitis are usually mild and occur about one week after initiation of aztreonam therapy, and are relieved by changing administration sites, applying warm packs and other general measures.⁽³⁾ Discomfort, pain, and swelling at the injection site have been reported in up to about 3% of patients receiving IM aztreonam.⁽³⁾ Anaphylaxis, angioedema and bronchospasm have been reported.⁽¹⁾

EXTRAVASATION:

No information available ⁽⁹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet in the administration set close to the cannula insertion site):⁽⁴⁾ Aminophylline, calcium gluconate, cefotaxime, ceftazidime, ciprofloxacin, clindamycin, dopamine, furosemide, gentamicin, heparin sodium, hydrocortisone sodium succinate, linezolid, magnesium sulphate, morphine, potassium chloride.

Note that the above are only compatible providing that both drugs are diluted in glucose 5%.

This list is not exhaustive, contact Pharmacy for further information.

Compatible infusion fluids: Glucose 10%,⁽³⁾ sodium chloride 0.9%,⁽¹⁾ sodium chloride 0.45%,⁽¹⁾ glucose 5%,⁽¹⁾ Ringer's solution,⁽¹⁾ compound sodium lactate (Hartmann's solution).⁽¹⁾

Incompatible: Metronidazole.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

Avoid inhalation, skin or eye contact with aztreonam ⁽⁸⁾

SODIUM CONTENT (mmol):

None ⁽⁴⁾

OSMOLARITY / OSMOLALITY:

No information available ⁽⁹⁾

pH:

4.5 to 7.5 dependent on type and amount of diluent used.⁽¹⁾⁽⁴⁾

OTHER COMMENTS:

1. Vials of aztreonam are not for multi-dose use.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Azactam®, ER Squibb & Sons Ltd, last revised 27/06/2011
2. Martindale accessed via www.medicinescomplete.com on 22/05/2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 22/05/2012
4. Trissel "Handbook on injectable drugs" 16th Edition 2011 accessed via <http://online.staref.com> on 30/05/2012
5. British National Formulary No. 53 March 2012 accessed via

www.medicinescomplete.com 30/05/2012

6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. Safety Data Sheet, Bristol-Myers Squibb. Version 3, 22/12/2010
9. Drug company name: Bristol-Myers Squibb. Date contacted: 30/05/2012 written and verbal communication

Version 3

Intravenous

Benzylpenicillin sodium

Contains a PENICILLIN.

MEDICINE NAME:

Benzylpenicillin sodium
(Penicillin G)

TRADE NAME(S):

Crystapen®

PRESENTATION OF MEDICINE:

Vial containing 600mg (1mega unit) benzylpenicillin sodium powder for reconstitution.⁽¹⁾
Vial containing 1.2g (2mega units) benzylpenicillin sodium powder for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection:

For doses less than 1.2g, administer slowly over 3-5minutes.⁽¹⁾
For 1.2g and above, the maximum rate of administration in adults is 300mg per minute.⁽¹⁾

IV Infusion: For doses over 1.2g, administer over 30-60minutes.⁽⁵⁾

INSTRUCTIONS FOR RECONSTITUTION:

IV injection:

For peripheral administration reconstitute each 600mg with 4 to 10mL of water for injections or sodium chloride 0.9%.⁽¹⁾⁽⁹⁾

For the 1.2g vial reconstitute with at least 8mL water for injections or sodium chloride 0.9%.⁽¹⁾⁽⁹⁾

For central administration, 600mg can be reconstituted in 4mL water for injections.⁽¹⁾

IV Infusion:

Reconstitute each 600mg vial and the 1.2g vial with 10mL water for injection,⁽¹⁾ and then dilute the dose required as described below.^{(1) (5)(9)}

DISPLACEMENT VALUE:

0.4mL per 600mg on reconstitution.⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: Dilute required dose in a suggested volume of 100mL with sodium chloride 0.9% or glucose 5%.⁽⁵⁾ Smaller volumes may be used if necessary.⁽¹⁾

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

24 hours⁽⁴⁾

FLUSHING:

Flush with sodium chloride 0.9% (preferred), glucose 5%.⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypersensitivity-rash, anaphylaxis.⁽²⁾ Administration faster than the recommended rate may cause seizures and central nervous toxicity.⁽²⁾ Large doses can cause hypokalaemia and hypernatraemia.⁽¹⁾

EXTRAVASATION:

The maximum concentration recommended for peripheral administration is 600mg in 10mL; higher concentrations are irritant due to high osmolality⁽¹¹⁾ and may cause tissue damage if extravasation occurs. If a higher concentration is needed a central line should be used for administration.⁽¹⁰⁾ If extravasation occurs, refer to local treatment guidelines.⁽¹⁰⁾

SPECIAL HANDLING PRECAUTIONS:

May cause allergic reactions in sensitive individuals. After contact with skin wash immediately with water.⁽⁸⁾

SODIUM CONTENT (mmol):

600mg vial contains 1.68mmol⁽⁵⁾

1.2g vial contains 3.36mmol⁽⁵⁾

OSMOLARITY / OSMOLALITY:

795mOsm/Kg 600mg in 4mL water for injections⁽⁴⁾

337mOsm/L 600mg in 10mL water for injections⁽¹¹⁾

645mOsm/L 600mg in 10mL sodium chloride 0.9%⁽¹¹⁾

381mOsm/L 2.4g in 100mL sodium chloride 0.9%⁽¹¹⁾

357mOsm/L 2.4g in 100mL glucose 5%⁽¹¹⁾.

pH:

5-7.5⁽³⁾⁽⁴⁾⁽¹¹⁾ See link.

OTHER INJECTABLE ROUTES OF ADMINISTRATION:

Intramuscular⁽¹⁾. Dissolve the contents of 600mg vial in 1.6 to 2mL of water for injections.

REFERENCES:

1. Summary of Product Characteristics. Crystapen®. Last revised July 2008
2. Martindale 4th Quarter 2010 update accessed via www.medicinescomplete.com. on 18/11/2010
3. American Hospital Formulary Service Drug Information, accessed via www.medicinescomplete.com on 18/11/2010
4. Trissel "Handbook on injectable drugs" 16th Edition accessed via www.medicinescomplete.com on 18/11/2010
5. British National Formulary No. 60 September 2010 accessed via www.bnf.org
6. Medicines For Children 2003
 - a) British National Formulary for Children 2010-2011 www.bnfc.org
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)

a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)

8. COSHH report compiled by manufacturer 28/06/2000
9. Drug company name: Genus Pharmaceuticals
Date contacted: 18/11/2010 and 20/06/2012
10. National Extravasation Service www.extravasation.org
11. Quality Assurance department Charing Cross Hospital, Imperial College NHS Trust
09/12/2010.

Version 3 (NHS Lothian local amendment)

Intravenous

Bumetanide

MEDICINE NAME:

Bumetanide

TRADE NAME(S):

PRESENTATION OF MEDICINE:

2mg in 4mL ampoules ⁽¹⁾

METHOD OF ADMINISTRATION:

IV bolus: 1-2mg over 1-2 minutes. ⁽¹⁾⁽⁴⁾

IV infusion: 2-5mg over 30-60 minutes. ⁽¹⁾⁽⁵⁾

IV infusion: Local policy (unlicensed) is to dilute doses greater than 2mg in 50mL diluent and administer:

3mg over at least 30 minutes

4mg over at least 45 minutes

5mg over at least 60 minutes. ⁽¹⁰⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Infusion 2mg - 5mg in 500mL of one of the following:

Glucose 5% ⁽¹⁾

Sodium chloride 0.9%. ⁽¹⁾

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

Use infusion within 24 hours of preparation

FLUSHING:

Sodium chloride 0.9%, glucose 5% ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Excessively rapid mobilisation of oedema, particularly in elderly patients may give rise to changes in cardiovascular pressure-flow relationships with cardiovascular collapse. ⁽¹⁾

In high doses in patients with chronic renal impairment it may cause severe musculoskeletal pain. ⁽²⁾

At high doses, after rapid administration in patients with impaired renal function, ototoxicity must be considered especially if the patient is taking other ototoxic medication. ⁽³⁾

Bumetanide may produce a profound diuresis which can result in fluid and electrolyte depletion. ⁽³⁾

Regular checks of fluid balance, serum electrolytes and blood pressure should be performed.

EXTRAVASATION:

Low risk. Isotonic

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet in the administration set close to the cannula insertion site):

Allopurinol, aztreonam, bivalirudin, cisatracurium, clarithromycin, diltiazem, doxapram, filgrastim, granisetron, melphalan, milrinone, morphine, pethidine, piperacillin/tazobactam, propofol, remifentanyl.⁽⁴⁾

Compatible with the following diluents in addition to those listed above: Glucose 4% with sodium chloride 0.18% intravenous infusion.⁽¹⁾

Incompatible:

Dobutamine, midazolam⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

None reported⁽⁹⁾

SODIUM CONTENT (mmol):

0.01mmol in 1mL⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Isotonic⁽⁹⁾

pH:

6.8 - 7.3⁽⁹⁾

OTHER COMMENTS:

1. Discard infusion if cloudy.⁽¹⁾
2. No evidence of precipitation observed over 72 hours when bumetanide 25mg was added to 1 litre of suitable diluent.⁽¹⁾
3. Chemically stable for 14 days at 5 to 25°C at up to 100mg/litre.⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics. Bumetanide, last updated May 2006
2. Martindale accessed via <http://www.medicinescomplete.com> december 2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> december 2011
4. Trissel "Handbook on injectable drugs" 14th Edition and electronic version
5. British National Formulary No. 62
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2011-12
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Leo Laboratories
Date contacted: 31/10/2011
10. South Devon Healthcare Trust IV monographs

Intravenous

Calcium folinate (Calcium leucovorin)

MEDICINE NAME:

Calcium folinate (Calcium leucovorin)

TRADE NAME(S):

Calcium folinate (Hospira UK Ltd, Sandoz (Ebewe), Teva UK), Refolinon® (Pfizer Ltd)

PRESENTATION OF MEDICINE:

Ampoules containing folinic acid 6mg in 2mL, 15mg in 2mL, 30mg in 10mL, 30mg in 3mL, 50mg in 5mL and 100mg in 10mL (as calcium) solution for injection or infusion.^{(1a)(1b)(1d)}

Vials containing folinic acid 3mg in 1mL, 10mg in 1mL, 50mg in 5mL, 100mg in 10mL, 200mg in 20mL, 300mg in 30mL, 350mg in 35mL, 500mg in 50mL and 800mg in 80mL (as calcium) solution for injection or infusion.^(1a-c)

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3-5 minutes.⁽¹⁰⁾

IV Infusion: Give over 15 minutes to 2 hours depending on the regime.

The rate of infusion should not exceed 160mg/minute.^(1a-d)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Give undiluted or dilute with sodium chloride 0.9% or glucose 5%.^(1a-d)

STABILITY

Prepare immediately before administration.

FLUSHING:

Sodium chloride 0.9%⁽¹⁰⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Very rarely allergic reactions and fever.^(1a-d) Monitor for allergic reactions.

Hypotension, vasomotor collapse, nausea, vomiting, hot flushes and sweating may occur if administered too rapidly because of the calcium content.⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Cisplatin, fluconazole, piperacillin/tazobactam.⁽¹⁰⁾

Incompatible: Incompatible with fluorouracil, foscarnet and methotrexate.^{(1c)(1d)(10)}

SODIUM CONTENT (mmol):

1. Hospira products - 0.2mmol/mL^(9a)
2. Sandoz (Ebewe) - 7.7mg/mL^(9b)
3. Teva UK - 0.1mmol/mL^(9c)
4. Refolinon - 0.1mmol/mL^(9d)

OSMOLARITY / OSMOLALITY:

The osmolality of Calcium folinate [Sandoz (Ebewe)], 10mg/mL, is 280mOsm/L and osmolality is 277mOsm/kg.^(9b)

The osmolality of Calcium folinate (Teva) 10mg/mL is between 280 and 290mOsm/kg.^(9c)
The osmolality of Refolinon solution for injection, 3mg/mL, is between 174 and 202mOsm/kg.^(9d)

pH:

pH 6.5 to 8.5 undiluted^(9a-d)

OTHER COMMENTS:

1. Keep vials and ampoules in outer container to protect from light.^(1a-d)
2. Store original containers at 2-8°C.^(1a-d)
3. Diluted solutions are stable for 24 hours at 2-8°C.^(1a-d)

REFERENCES:

1. Summary of Product Characteristics
 - a) Calcium folinate (Hospira) last revised 02/06/2009
 - b) Calcium folinate [Sandoz (Ebewe)], last revised September 2005
 - c) Calcium folinate (Teva UK), last revised 01/07/2006
 - d) Refolinon® (Pfizer) last revised 01/07/2006
2. Martindale "The Complete Drug Reference" 34th Edition - not used
3. American Hospital Formulary Service Drug Information - not used
4. Trissel "Handbook on injectable drugs" - not used
5. British National Formulary No. 60, September 2010
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003 - not used
 - a) British National Formulary for Children 2010-11 - not used
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#) - not used
8. COSHH report compiled by the manufacturer
9.
 - a) Drug company name: Hospira UK Ltd. Date contacted: 08/09/2010
 - b) Drug company name: Sandoz. Date contacted: 01/03/2011
 - c) Drug company name: Pfizer. Date contacted: 08/03/2010
 - d) Drug company name: Pfizer Ltd. Date contacted: 09/08/2010
10. UCL Hospitals Injectable Drug Administration Guide 2nd Edition 2007

Version 3 (NHS Lothian local amendment)

Intravenous

Calcium gluconate

MEDICINE NAME:

Calcium gluconate

TRADE NAME(S):

Generic, hameln pharmaceuticals^(1a)

PRESENTATION OF MEDICINE:

Ampoules containing calcium gluconate 10% (2.2mmol of calcium in 10ml) ^(1a)

METHOD OF ADMINISTRATION (adult):

IV injection: In an emergency (e.g. severe acute hypocalcaemia, cardiac resuscitation, hypocalcaemic tetany) calcium gluconate 10% can be given undiluted by a slow IV injection. Each 10mL (one ampoule) should be preferably administered over a minimum 3 minutes.^(1a) In such situations ECG monitoring is highly advisable.⁽⁵⁾

Due to extreme osmolarity preferably administer calcium gluconate 10% via a central venous access device.⁽¹³⁾

IV infusion: Calcium gluconate 10% injections may be administered in a large volume of sodium chloride 0.9% or glucose 5%.⁽⁵⁾ Doses of calcium gluconate 10% for intravenous infusion may vary considerably in practice. For example: ADULT: Dilute 100ml (10 x 10ml ampoules) of calcium gluconate 10% in 1 litre of glucose 5% or sodium chloride 0.9% and give at an initial rate of 50ml/hour adjusted according to response.⁽⁵⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

IV infusion: The required number of ampoules can be further diluted with a suitable volume of sodium chloride 0.9% or glucose 5%.⁽⁵⁾ As a suggestion dilute each 10mL of calcium gluconate 10% to 100mL with sodium chloride 0.9% or glucose 5% (i.e. 1 in 10 dilution to a concentration of 10mg/mL).^(1b) However, the dilution used will depend on the type of available venous access and the fluid requirements of each individual patient.

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

24 hours.⁽¹⁰⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.^{(1a)(1b)}

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Rapid IV administration may cause asystole, bradycardia, decrease in blood pressure, cardiac arrhythmias, syncope and cardiac arrest.^{(1a)(1b)} Too rapid intravenous administration of calcium salts may lead to symptoms of hypercalcaemia, a chalky taste, hot flushes and peripheral vasodilation.⁽²⁾ Wherever possible intravenous calcium gluconate should be administered with ECG, blood pressure and plasma-calcium monitoring.

EXTRAVASATION:

Calcium salts are irritant. Extravasation may cause tissue irritation and necrosis.⁽⁴⁾

The infusion site must be monitored regularly to ensure extravasation injury has not occurred.^(1b)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

This information must be used in conjunction with the Injectable Medicines Guide 'help' guidance.

Calcium gluconate infusion is compatible with the following infusions (it is assumed that medicines meet close to the vascular access device): Potassium chloride.⁽⁴⁾

Incompatible: Calcium salts are incompatible with oxidising agents, citrates, soluble carbonates, bicarbonates, phosphates, tartrates and sulfates.^(1a)

Physical incompatibility has also been reported with amphotericin, ceftriaxone, dobutamine hydrochloride, prochlorperazine and tetracyclines.^(1a) Calcium salts can form complexes with many drugs, and this may result in a precipitate,^(1a) therefore do not infuse with any other medicines or infusions unless the compatibility has been established.

SPECIAL HANDLING PRECAUTIONS:

No special handling precautions are advised.⁽⁸⁾

SODIUM CONTENT (mmol):

Nil.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Calculated Osmolarity (mOsmol/L)⁽¹²⁾

10% (undiluted ampoule) - 726 mOsmol/L

10ml diluted into 100ml 0.9% sodium chloride - 346 mOsmol/L

pH:

6.0 to 7.0⁽⁹⁾

OTHER COMMENTS:

1. Calcium gluconate injection packed in small-volume glass containers is contraindicated for use as repeated or prolonged treatment as well as intravenous infusions, in children younger than 18 years and in patients with renal impairment. Aluminium can be leached from glass after contact with calcium gluconate solution, this can lead to a risk of exposure to aluminium. Accumulation of aluminium might have adverse effects on bone mineralisation and neurological development in children and those with renal impairment.⁽¹¹⁾
2. Store at less than 25°C.^{(1a)(8)}

REFERENCES:

1. Summary of Product Characteristics
 - a) Calcium gluconate 9.5%, hameln pharmaceuticals Ltd., last revised 23/07/2010
 - b) Calcium gluconate 10%, B Braun (Medical), last revised June 2005.

2. Martindale. The Complete Drug Reference. Accessed via <http://www.medicinescomplete.com> on 20/09/2013
3. American Hospital Formulary Service Drug Information. Accessed via <http://www.medicinescomplete.com> on 02/09/2013
4. Trissel "Handbook on injectable drugs". Accessed via <http://www.medicinescomplete.com> on 02/09/2013
5. British National Formulary No. 65 March 2013
6. British National Formulary for Children 2011-2012. <http://bnfc.org/bnfc>
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by manufacturer hameln Pharmaceuticals
9. Drug company name: hameln Pharmaceuticals.
Date contacted: 26/09/2012
10. NPSA Safety Alert 20
11. Drug Safety Update (MHRA) Volume 4. Issue, 1 August 2010 [Link to report](#)
12. Quality Assurance Department, Imperial College Healthcare NHS Trust 25/10/2010
13. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 3

Intravenous

Caspofungin

MEDICINE NAME:

Caspofungin

TRADE NAME(S):

Cancidas®

PRESENTATION OF MEDICINE:

Vials containing caspofungin 50mg powder (as acetate) ⁽¹⁾

Vials containing caspofungin 70mg powder (as acetate) ⁽¹⁾

METHOD OF ADMINISTRATION:

IV infusion - Over one hour ⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

IV infusion: Bring vial to room temperature and add 10.5mL water for injections. The resultant strength will be an average of 5.2mg per mL (50mg vial) or 7.2mg per mL (70mg vial). ⁽¹⁾

DISPLACEMENT VALUE:

See 'Instructions for reconstitution' section of monograph above

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Preparation of infusion: Add the required dose (volume) from the reconstituted vial to a 250mL bag of sodium chloride 0.9%. ⁽¹⁾

Maximum concentration 0.45mg per mL but such strong concentrations are not recommended for doses above 50mg. ⁽¹⁾

Do not use or co-infuse with diluents containing glucose.

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Cancidas® contains no preservatives. From a microbiological point of view, the product should be used immediately. ⁽¹⁾

FLUSHING:

Sodium chloride 0.9%. Do not use glucose 5%. ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Phlebitis and other local reactions are commonly reported. ⁽¹⁾

Hypersensitivity reactions (including anaphylaxis have been reported). ⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

NB diluent must be sodium chloride 0.9%.

Aciclovir, alfentanil, allopurinol, amikacin, aminophylline, amiodarone, atracurium, aztreonam, calcium chloride, calcium gluconate, ciprofloxacin, cisatracurium, dobutamine, dopamine, epinephrine, erythromycin, esmolol, fentanyl, fluconazole, ganciclovir, gentamicin, granisetron, haloperidol, hydrocortisone, imipenem, insulin, isoprenaline, labetalol, magnesium sulphate, mannitol, metoclopramide, midazolam, milrinone,

morphine, norepinephrine, quinupristin-dalfopristin, remifentanyl, rocuronium, sufentanyl, tacrolimus, thiopental, tobramycin, vasopressin, vecuronium, zidovudine. ⁽¹⁰⁾

SPECIAL HANDLING PRECAUTIONS:

No information available. ⁽¹⁾

SODIUM CONTENT (mmol):

50mg vial = 0.028mmol/vial ⁽⁹⁾

70mg vial = 0.04mmol/vial ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information available ⁽⁹⁾

pH:

Reconstituted, undiluted drug - pH 6.6 ⁽⁹⁾

OTHER COMMENTS:

1. There are different doses recommended for adults and paediatrics but the infusion preparation and administration information is the same. ⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics last updated December 2008
2. Martindale "The Complete Drug Reference"
3. American Hospital Formulary Service Drug Information
4. Trissel "Handbook on injectable drugs" 13th Edition
5. British National Formulary no. 56
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003
 - a) British National Formulary for Children 2007
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
9. Drug company name: Merck Sharp & Dohme
Date contacted: 5th December 2008

Version 3

Intravenous

Cefotaxime

Contains a PENICILLIN-like structure

Some information in this monograph is brand specific. Ensure you refer to the correct information for the brand used in your organisation.

MEDICINE NAME:

Cefotaxime

TRADE NAME(S):

Generic (Genus Pharmaceuticals)
Generic (Wockhardt UK Ltd)
Generic (Bowmed - ACS Dobfar Generics)
Generic (Lupin (Europe) Ltd)

PRESENTATION OF MEDICINE:

Vials containing cefotaxime 500mg (as sodium salt).^(1a-d)
Vials containing cefotaxime 1g (as sodium salt).^(1a-d)
Vials containing cefotaxime 2g (as sodium salt).^{(1a-b)(1d)}

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3-5 minutes.^{(1a-d)(4)(10)(11)}

IV infusion: Administer over 20-60 minutes.^{(1a-d)(4)(10)(11)}

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute vials containing 500mg cefotaxime with 2mL water for injections.^(1a-d)
Reconstitute vials containing 1g cefotaxime with 4mL water for injections.^(1a-d)
Reconstitute vials containing 2g cefotaxime with 10mL water for injections.^{(1a-b)(1d)}
Shake well until dissolved and then withdraw the required volume from the vial into the syringe and use immediately.^(1a-d)

DISPLACEMENT VALUE:

500mg displaces 0.2mL - approximate^(9a-c)
1g displaces 0.5mL - approximate^(9a-b)
1g displaces 0.4mL - approximate^(9c)
2g displaces 1.2mL - approximate^{(9a-b)(9d)}

Please ensure that you refer to the correct information for the brand used in your organisation as there is variability between different brands.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: Dissolve each 1-2g in 40-100mL sodium chloride 0.9% or glucose 5%.^(1a-d)

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Prepare immediately before use.^(1a-d)

EXAMPLE CALCULATION:

Cefotaxime 1g in 40-100mL sodium chloride 0.9% administered over 20-60 minutes.
Cefotaxime 2g in 40-100mL sodium chloride 0.9% administered over 20-60 minutes.

FLUSHING:

Sodium chloride 0.9% or glucose 5%.⁽¹⁰⁾⁽¹¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Transient pain at the site of injection. This is more likely to occur with higher doses.
(1a-d)
2. Occasionally phlebitis. (1a-d)
3. Arrhythmias following rapid bolus infusion through a central venous access device.
(1a-d)

EXTRAVASATION:

No information (9a-d)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Metronidazole infusion, (1a-b)(11) aciclovir, (4)(10)(11) heparin, (10)(11) morphine sulphate, (4)(11) midazolam. (4)(11)

Incompatible: Alkaline agents e.g. sodium bicarbonate, (1a)(1b)(1d)(10)(11) aminophylline, (1a)(1d)(4)(10)(11) fluconazole, (4)(11) aminoglycosides. (10)(11)

SPECIAL HANDLING PRECAUTIONS:

Avoid contact with eyes and skin. Do not inhale dust. (8)

SODIUM CONTENT (mmol):

2.09mmol sodium per 1g vial. (1a-d)(2)(10)(11)

OSMOLARITY / OSMOLALITY:

No information (9a)(9c)

pH:

pH of reconstituted solutions is 5 to 7.5 (4)(10)(11)(12)

REFERENCES:

1. Summary of Product Characteristics
 - a) Cefotaxime injection, Genus Pharmaceuticals. Date of partial revision of text 23 July 2008
 - b) Cefotaxime injection, Wockhardt UK Ltd. Date of first authorisation 13 October 2007 (2g), 16 October 2007 (500mg & 1g)
 - c) Cefotaxime sodium injection (Bowmed (ACS Dobfar Generics)). Date of revision of text 20 October 2009
 - d) Cefotaxime sodium, Lupin (Europe) Ltd. Date of renewal of authorisation 16 February 2010
2. Martindale "The Complete Drug Reference" 36th Edition p269
3. American Hospital Formulary Service Drug Information Accessed via www.medicinescomplete.com on 14 March 2008
4. Trissel "Handbook on injectable drugs" 15th Edition p287
5. British National Formulary No. 59 March 2010, pg 328
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 p100
 - a) British National Formulary for Children 2009 p322
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov](#)

[2010](#)

a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)

8. COSHH report compiled by manufacturer: Genus Pharmaceuticals Date of revision: 22 July 1999
9. a) Drug company name: Genus Pharmaceuticals; Date contacted: 14 March 2008
b) Drug company name: Wockhardt UK Ltd; Date contacted: 14 March 2008
c) Drug company name: Bowmed Ibisqus Ltd; Date contacted 26 August 2009
d) Drug company name: Lupin (Europe) Ltd; Date contacted: 21 August 2009
10. Hammersmith Hospitals Intravenous Medicine Administration Guide November 2004
11. UCL Hospitals Injectable Medicines Administration Guide 2nd edition
12. Bard website www.accessability-by-bard.co.uk. Date accessed: 14 March 2008

Version 2 (NHS Lothian local amendment)

Intravenous

Ceftazidime

Contains a PENICILLIN-like structure

Some information in this monograph is brand specific. Ensure you refer to the correct information for the brand used in your organisation.

MEDICINE NAME:

Ceftazidime

TRADE NAME(S):

Fortum[®]
Kefadim[®]

Ceftazidime - generics (Wockhardt, Sandoz, Stragen, Villerton Invest
SA (supplier, Bowmed Ibisqus Ltd), Fresenius Kabi)

PRESENTATION OF MEDICINE:

Vials containing:

ceftazidime 500mg (as pentahydrate) powder for reconstitution

ceftazidime 1g (as pentahydrate) powder for reconstitution

ceftazidime 2g (as pentahydrate) powder for reconstitution

ceftazidime 3g (as pentahydrate) powder for reconstitution.

METHOD OF ADMINISTRATION:

After reconstitution (see table in 'Instructions for Reconstitution' section of monograph below) ceftazidime may be given as follows:^(1a-g)

IV injection: Give by slow IV injection e.g. over 3-5 minutes.

IV infusion: Give over 20 to 30 minutes.

INSTRUCTIONS FOR RECONSTITUTION:

Ceftazidime vials may contain a vacuum to assist injection of the diluent. When ceftazidime is dissolved, carbon dioxide is released and a positive pressure develops. To reconstitute vial please follow the instructions in the packet inset which are summarised below:^(1a-g)

For IV injection, follow steps 1-3

For IV infusion, follow steps 1-3 and then further dilute as described below

1. Insert the syringe needle through the vial closure and inject the recommended volume of diluent. Remove the syringe needle.
2. Shake to dissolve: carbon dioxide is released and a clear solution will be obtained in about 1 to 2 minutes.
3. Invert the vial. With the syringe plunger fully depressed, insert the needle through the vial closure and withdraw the total volume of solution into the syringe (the pressure in the vial may aid withdrawal). Ensure that the needle remains within the solution and does not enter the head space. The withdrawn solution may contain small bubbles of carbon dioxide; these should be expelled before injection.

Solutions range from light yellow to amber depending on concentration, diluent and storage conditions used. Within the stated recommendations, product potency is not adversely affected by such colour variations.

DISPLACEMENT VALUE:

Brand/ Manufacturer	Vial size	Route	Volume of diluent to add	Approximate Concentration (mg/mL)	Diluent	Approximate Displacement Value
Fortum	500mg	IV injection	5mL	90	Water for injections	0.43mL
	1g	IV injection	10mL	90		0.87mL
	2g	IV injection	10mL	170		1.7mL
	2g	IV Infusion	50mL [*]	40	Sodium chloride 0.9% or glucose 5%‡	1.7mL
	3g	IV injection	15mL	170	Water for injections	2.6mL
	3g	IV infusion	75mL [*]	40	Sodium chloride 0.9% or glucose 5%‡	2.6mL
Stragen	3g	IV injection	15mL	170	Water for injections	2mL
	3g	IV infusion	75mL [*]	40	Sodium chloride 0.9% or glucose 5%‡	2mL
Kefadim	1g	IV injection	10mL	92	Water for injections	0.85mL
	2g	IV injection	10mL	170		1.7mL
	2g	IV infusion	100mL [*]	20	Sodium chloride 0.9% or glucose 5%‡	1.7mL
Sandoz	1g	IV injection	10mL	91	Water for injections	1mL
Wockhardt	1g	IV injection	10mL	90	Water for injections	0.56mL
	2g	IV injection	10mL	170		1.5mL
	2g	IV infusion	50mL [*]	40	Sodium chloride 0.9% or glucose 5%‡	1.5mL
Fresenius Kabi	500mg	IV injection	5mL	90	Water for injections	0.45mL
	1g	IV injection	10mL	90		0.9mL
	2g	IV injection	10mL	170		1.8mL
	2g	IV infusion	50mL [*]	40	Sodium chloride 0.9%‡	1.8mL
Villerton Invest SA (Bowmed Ibisqus Ltd)	500mg	IV injection	5mL	96	Water for injections	0.2mL
	1g	IV injection	10mL	95		0.5mL
	2g	IV injection	10mL	172		1.6mL
	2g	IV infusion	50mL [*]	39	Sodium chloride 0.9% or glucose 5%‡	1.7mL

‡Note: Use sodium chloride injection 0.9%, glucose injection 5% or other approved diluents (see compatibility list below) as water for injections produces hypotonic solutions at this concentration.

*Note: Addition should be in two stages, follow instructions for dilution.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Intravenous infusion⁽¹⁾ Reconstitute the vials as described above.

Withdraw a volume containing the required dose and add to a suitable volume of compatible infusion fluid (usually sodium chloride 0.9% or glucose 5%). Use a minimum of 50mL for a 2g dose and a minimum of 100mL for a 3g dose.

Consult product literature for reconstitution directions for Fortum Monovial®.

STABILITY:

Prepare immediately before administration.

FLUSHING:

Flush with sodium chloride 0.9% ⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Phlebitis and thrombophlebitis in 2.4% of patients receiving IV injections.

Very rarely paraesthesia, angioedema and anaphylaxis. ⁽¹⁾⁽⁵⁾

EXTRAVASATION:

No specific recommendation issued by the manufacturer.⁽⁹⁾ If extravasation occurs refer to local extravasation policy.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusion fluids: Sodium chloride 0.9%, compound sodium lactate injection (Hartmann's solution), Ringer lactate solution, glucose 5% and sodium chloride 0.45%, glucose 5%, glucose 10%, glucose 4% with sodium chloride 0.18%. ⁽¹⁾⁽⁴⁾

Ceftazidime infusion is compatible with the following infusions (it is assumed that medicines meet close to the vascular access device): Aciclovir,⁽⁴⁾ clindamycin,⁽⁴⁾ flucloxacillin,⁽⁹⁾⁽¹⁰⁾ heparin,⁽⁴⁾ insulin,⁽⁴⁾ labetalol,⁽⁴⁾ metronidazole,⁽⁴⁾ morphine,⁽⁴⁾ tacrolimus.⁽⁴⁾

Incompatible: Aminophylline,⁽⁴⁾ acetylcysteine,⁽⁴⁾ amiodarone,⁽¹⁰⁾ amphotericin,⁽¹⁰⁾ clarithromycin,⁽¹⁰⁾ caspofungin,⁽⁴⁾ dobutamine,⁽¹⁰⁾ erythromycin,⁽⁴⁾ fluconazole,⁽⁴⁾ gentamicin,⁽⁴⁾ midazolam,⁽¹⁰⁾⁽¹¹⁾ pheytoin sodium,⁽⁴⁾ ranitidine,⁽⁴⁾ sodium bicarbonate,⁽¹⁰⁾⁽¹¹⁾ thiopental,⁽¹¹⁾ vancomycin.⁽¹⁾⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

No special control measures required for the normal handling of this product, however, it may cause allergic skin reactions and difficulty breathing through accidental over exposure.⁽⁸⁾

SODIUM CONTENT (mmol):

Between 2.23mmol and 2.34mmol per gram of ceftazidime^{(1)(9b)}

OSMOLARITY / OSMOLALITY:

50mg/mL in glucose 5% = 321mOsm/kg.⁽⁴⁾

50mg/mL in sodium chloride 0.9% = 330mOsm/kg.⁽⁴⁾

pH:

Between 5 and 8 ⁽⁴⁾⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Kefadim (Flynn Pharma), last revised 01/06/2005
 - b) Ceftazidime 1g and 2g for injection (Wockhardt), last revised July 2011
 - c) Fortum for injection, GlaxoSmithKline, last revised September 2012
 - d) Ceftazidime for injection (Sandoz Ltd), last revised 9/4/2011
 - e) Ceftazidime 3g powder for solution for infusion (Stragen UK Ltd), last revised 28/02/2008
 - f) Ceftazidime 500mg, 1g and 2g powder for solution for injection, (MAH: Villerton Invest SA, distributed by Bowmed Ibisqus Ltd) last revised 31/10/2011
 - g) Ceftazidime 500mg, 1g and 2g powder for solution for injection, Fresenius Kabi, last revised 06/04/2009
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com 21/01/2011
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com 21/01/2011
4. Trissel "Handbook on injectable drugs" 15th Edition accessed via <http://www.medicinescomplete.com> 09/10/2012
5. British National Formulary No. 64 September 2012 page 354
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2012-2013 page 273
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer GlaxoSmithKline UK
9.
 - a) Drug company name: Flynn Pharma. Date contacted: 20/01/2011
 - b) Drug company name: Glaxo Laboratories. Date contacted: 21/01/2011
 - c) Drug company name: Wockhardt. Date contacted: 20/01/2011
 - d) Drug company name: Stragen UK Ltd. Date contacted: 21/01/2011
 - f) Drug company name: Bowmed (ACS Dobfar). Date contacted: 05/01/2011
 - g) Drug company name: Sandoz UK Ltd. Date contacted: 20/01/2011
 - h) Drug company name: Fresenius Kabi. Date contacted: 14/01/2011
10. Injectable Drugs Guide. Gray A, Goddey V, Wright J, Bruce L. 2011
11. UCL Hospitals Injectable Medicines Administration Guide. 2010

Version 2 (Local amendment for NHS Lothian)

Intravenous

Ceftriaxone

Contains a **PENICILLIN-like structure**

Some information in this monograph is brand specific. Ensure you refer to the correct information for the brand used in your organisation.

MEDICINE NAME:

Ceftriaxone

TRADE NAME(S):

Rocephin® injection (Roche)
Ceftriaxone injection BP (Lupin/Stravencon/Villerton (Bowmed
Ibisqus Ltd)/Wockhardt)

PRESENTATION OF MEDICINE:

Vials containing ceftriaxone (as sodium salt) powder for reconstitution.

Roche/Villerton (Bowmed Ibisqus Ltd): 250mg, 1g and 2g vials

Lupin: 250mg vials

Wockhardt/Stravencon: 1g and 2g vials

METHOD OF ADMINISTRATION:

Adults and children 50kg and over

IV Injection: Give doses of 250mg to 1g by slow **IV injection** over 2 to 4 minutes.⁽⁵⁾

IV infusion: Give doses higher than 1g to less than 4g doses over at least 30 minutes.^{(1a)(1d)(5)}

To give a 4g or higher dose, administer each 2g infusion over at least 30 minutes.^(1a-e)

Children less than 50kg

IV injection: Give doses less than 50mg/kg by slow IV injection over 2 to 4 minutes.^(6a)

IV infusion: Give doses of 50mg/kg and over or single doses of 1g (regardless of patient weight) via intravenous infusion over at least 30 minutes.^(6a)

Neonates:

Do not administer by IV injection.

IV infusion: Give all doses over 60 minutes to reduce the displacement of bilirubin from albumin.^{(1a-d)(6a)}

INSTRUCTIONS FOR RECONSTITUTION:

250mg vial: Reconstitute with 5mL of water for injections.^{(1a)(1d)}

1g vial: Reconstitute with 10mL of water for injections.^{(1a-b)(1d-e)}

2g vial: Reconstitute with 40mL sodium chloride 0.9% or glucose 5%.^{(1a-b)(1d-e)}

It has been identified from practice that Stravencon 2g vials are smaller than those provided by other manufacturers and cannot hold the 40mL. The manufacturer, therefore, recommends adding 15mL of sodium chloride 0.9% or glucose 5% to the vial, drawing the vial contents into a 50mL syringe and then diluting to a final volume of 40mL.^(9c) Alternatively: If a syringe pump is unavailable, reconstitute a 2g vial with 15mL diluent; draw up into a syringe and add to either 50mL or 100mL sodium chloride 0.9% or glucose 5%.

The manufacturers are working to resolve this issue. This monograph will be updated

accordingly at that point.

For 4g doses: For all manufacturers **except Stravencon**, two 2g vials are reconstituted, each one with 40mL diluent and each one is administered over 30 minutes, back to back. [Note: the hangers provided with each vial are attached to each 2g vial and the ceftriaxone administered directly from the vial.]

For Stravencon brand, to deliver 4g dose reconstitute 2 x 2g vials with 15mL of sodium chloride 0.9% or glucose 5% each; draw up into a syringe and add to 100mL sodium chloride 0.9% or glucose 5%.

Shake vial until solution is clear.

Let the vial stand until no bubbles are present in the solution.

Ceftriaxone forms a pale yellow to amber solution when dissolved in water for injections.^{(1a-e)(4)}

Variations in the intensity of colour of freshly prepared solutions do not indicate a change in potency or safety. Do not use if particles are present.^(1a)

DISPLACEMENT VALUE:

Roche:^(9d) 0.2mL per 250mg vial; 0.7mL per 1g vial; 1.4mL per 2g vial.

Wockhardt:^(1b) 0.5mL per 1g vial; 1mL per 2g vial.

Lupin:^(9a) 0.2mL per 250mg vial.

Stravencon:^(9c) 0.6mL per 1g vial; 1.3mL per 2g vial.

Villerton (Bowmed Ibisqus Ltd):^(9e) 0.1mL per 250mg vial, 0.6mL per 1g vial, 1.2mL per 2g vial.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Following reconstitution of vials as described above no further dilution is required with the exception of Stravencon brand (see above details under reconstitution).^{(1a-d)(9c)}

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Prepare immediately before use.^(1a-e)

Discard any remaining solution within 6 hours of preparation.^(1a)

FLUSHING:

Sodium chloride 0.9%^(9a)

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Occasionally, phlebitis and pain at injection site may occur.^(1a)

This can be minimised by slow injection over at least 2 to 4 minutes.

Severe anaphylactic reactions can occur in some patients, causing respiratory distress and/or vascular collapse.^(1a-e)

Milder reactions such as itching or rashes can occur.

A 2g dose of ceftriaxone should be administered over 30 minutes as recommended by the manufacturer to avoid adverse reactions.⁽³⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

When giving by IV injection do not administer via an infusion that contains a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

There is no information available on the compatibility of ceftriaxone infusion with other medicine containing infusions

Ceftriazone is compatible with the following infusion fluids: Glucose 10%, sodium chloride 0.45% and glucose 2.5%.

Incompatible: Ceftriaxone is incompatible with calcium containing solutions such as compound sodium lactate solution and Ringer's solution (see 'other comments' section below for further details).⁽¹⁰⁾

SODIUM CONTENT (mmol):

3.6mmol per gram of ceftriaxone ^{(1a)(4)(9d)(9e)}

OSMOLARITY / OSMOLALITY:

At a concentration of 50mg/mL in glucose 5% = 351mOsm/kg.⁽⁴⁾

At a concentration of 50mg/mL in sodium chloride 0.9% = 364mOsm/kg.⁽⁴⁾

pH:

6.7 (range 6 to 8).⁽⁴⁾

OTHER COMMENTS:

1. Do not administer to a patient with previous immediate and/or severe hypersensitivity reaction to a penicillin or to any other beta-lactam medicine.^(1a-e)
2. Antibiotic associated diarrhoea, colitis and pseudomembranous colitis have been reported with the use of ceftriaxone. These diagnoses should be considered in any patient who develops diarrhoea during or shortly after treatment. Discontinue if severe and/or bloody diarrhoea occurs during treatment.^(1a-e)
3. The dose will need to be reduced in severe renal impairment.^{(1a-e)(11)}
4. The MHRA⁽¹⁰⁾ advise that ceftriaxone should not be given simultaneously with calcium-containing solutions (other than total parenteral nutrition solutions) for intravenous administration because of a risk of calcium precipitation. Ceftriaxone is contraindicated in full-term newborns up to age 28 days who need intravenous treatment with calcium-containing solutions because of the risk of precipitation of calcium-ceftriaxone salts. However calcium and ceftriaxone may be infused sequentially in patients aged 28 days or older provided that either a) the infusion line is flushed between solutions, or b) the infusions are given via different infusion lines at different sites. In patients requiring continuous nutrition with calcium-containing TPN solutions, clinicians may wish to consider using alternative antibiotic treatment which does not carry a similar risk of precipitation. If there is no alternative, then administration can simultaneously be given via different infusion lines at different sites.
5. 12/06/2012 Ranbaxy product is no longer available.

REFERENCES:

1. Summary of Product Characteristics
 - a) Roche, last updated 07/07/2010
 - b) Wockhardt UK Ltd, last updated 02/12/2010

- c) Lupin, last updated 31/03/2010
- d) Villerton, distributed by Bowmed Ibisqus Ltd, last updated 31/10/2011
- e) Stravencon, last updated 31/10/2011
- 2. Martindale "The Complete Drug Reference 2011, 37th Edition"
- 3. American Hospital Formulary Service Drug Information
- 4. Trissel "Handbook on injectable drugs" 16th Edition
- 5. British National Formulary No. 63, March 2012
- 6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003
- 6a) British National Formulary for Children 2011-2012
- 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
- 8. COSHH report compiled by the manufacturer
- 9. a) Drug company name: Lupin. Date contacted: 06/01/2012
- b) Drug company name: Ranbaxy. Date contacted 03/01/2012
- c) Drug company name: Stravencon. Date contacted 04/05/2012
- d) Drug company name: Roche. Date contacted: 23/02/2012
- e) Drug company name: Bowmed Ibisqus Ltd. Date contacted: 06/02/2012
- 10. Drug Safety Bulletin produced by the MHRA October 2009
- 11. Renal Drug Handbook 2nd Edition

Version 6

Intravenous

Cefuroxime

Contains a PENICILLIN-like structure

MEDICINE NAME:

Cefuroxime

TRADE NAME(S):

Zinacef®

Cefuroxime (Stravencon, Flynn Pharma, Villerton Invest SA)

PRESENTATION OF MEDICINE:

Viials containing:

Cefuroxime 250mg (as sodium) powder for reconstitution.^{(1a)(1c-d)}

Cefuroxime 750mg (as sodium) powder for reconstitution.^{(1a-b)(1d)}

Cefuroxime 1.5g (as sodium) powder for reconstitution.^{(1a-b)(1d)}

METHOD OF ADMINISTRATION (adult):

ADULT and CHILD

IV injection: Give by slow IV injection over 3-5 minutes.^(1a-d)

IV infusion: Give over 30 minutes.^{(1a)(1c-d)}

INSTRUCTIONS FOR RECONSTITUTION (adult):

Reconstitute with water for injections. Add at least:

2mL to a 250mg vial^{(1a)(1c-d)}

6mL to a 750mg vial^{(1a-b)(1d)}

15mL to a 1.5g vial^{(1a-b)(1d)}

Shake gently to produce a clear solution.^(1c)

DISPLACEMENT VALUE:

250mg vial: 0.1-0.2mL.^{(1c-d)(9a)}

750mg vial: 0.5-0.6mL.^{(1d)(9a-b)}

1.5g vial: 1.0-1.2mL.^{(1d)(9a-b)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

IV infusion: Dilute dose required to 50mL with sodium chloride 0.9% or glucose 5%.^(1a-d)

Although water for injections is recommended by the manufacturer as a suitable diluent for the infusion, it is rarely used in practice as it is likely to cause haemolyses and hyperkalaemia.

STABILITY

Prepare immediately before administration.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.^(1a-d)

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Special care is indicated in patients who have experienced an allergic reaction to penicillins or any other beta-lactam antibiotics as cross-reactions may occur.^(1a-d)

Hypersensitivity, anaphylaxis, thrombophlebitis and pain at injection site.^(1a-d)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

This information must be used in conjunction with the Injectable Medicines Guide 'help' guidance.

Compatible infusions (it is assumed that medicines meet close to the vascular access device): Amiodarone (in glucose 5%), aciclovir (in glucose 5%), atracurium (in glucose 5%), foscarnet, granisetron (in glucose 5%), morphine (in glucose 5%), ondansetron, propofol (in glucose 5%), remifentanyl, tacrolimus, vecuronium bromide (in glucose 5%).⁽⁴⁾

Compatible infusion fluids:

Glucose 10%, sodium chloride and glucose (Ringer's Solution for injection), sodium lactate compound (Hartmann's solution),^(1b-d) glucose 5% infusion containing 20mmol potassium chloride, sodium chloride 0.9% containing 10mmol potassium chloride.^(1b)

Incompatible: Aminoglycosides (amikacin, gentamicin, neomycin, tobramycin),^(1a-d) ciprofloxacin, fluconazole, midazolam.⁽⁴⁾

N.B. Cefuroxime should not be mixed in the same syringe with aminoglycoside antibiotics.^(1a-d)

SODIUM CONTENT (mmol):

250mg vial: negligible.^(1c-d)

750mg vial: 1.7-1.8mmol^{(1d)(5)(9b)}

1.5g vial: 3.4-3.5mmol^{(1d)(9b)}

OSMOLARITY / OSMOLALITY:

671-686mOsm/kg (in 1.5g in 15mL sodium chloride 0.9%).^(9c)

315mOsm/kg (in 30mg in 1mL glucose 5%).⁽³⁾⁽⁴⁾

pH:

pH 5.5 to 8.5 in water for injections.^(9c)

OTHER COMMENTS:

1. Protect from vials from light and do not store above 25°C.^{(1a)(1b)(1d)}

REFERENCES:

1. Summary of Product Characteristics
 - a) Zinacef®. GlaxoSmithKline. Last revised 27/01/2012
 - b) Cefuroxime sodium injection. Flynn Pharma Ltd. Last revised January 2009
 - c) Cefuroxime sodium injection. Villerton Invest SA distributed by Bowmed Ibisqus Ltd. Last revised 31/10/2011
 - d) Cefuroxime sodium injection. Stravencon Ltd. Last revised 05/03/2012
2. Martindale accessed via MedicinesComplete on 25/10/2013
3. American Hospital Formulary Service Drug Information, accessed via MedicinesComplete on 25/10/2013
4. Trissel "Handbook on injectable drugs" 17th Edition 2012, pg 247-252
5. British National Formulary No. 66 September 2013-March 2014, pg 364-365 and 1010
6. British National Formulary for Children July 2013-2014 pg 273
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)

- a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
- 8. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
- 9. a) Drug company name: GlaxoSmithKline. Date contacted: 30/10/2013
b) Drug company name: Flynn Pharma Ltd. Date contacted: 23/10/2013
c) Drug company name: Bowmed Ibisqus Ltd. Date contacted: 23/10/2013
d) Drug company name: Stravencon Ltd. Date contacted: 23/10/2013
- 10. Patient Information Leaflet, Zinacef®, GlaxoSmithKline. Last revised August 2009

Version 7

Intravenous

Chloramphenicol

MEDICINE NAME:

Chloramphenicol

TRADE NAME(S):

Kemicetine®

PRESENTATION OF MEDICINE:

Vials containing chloramphenicol 1g (as sodium succinate) powder for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: Given by IV injection over at least one minute.⁽¹⁾ It should be given at a concentration of 10% (100mg per mL) or less.⁽¹⁾

IV infusion: Administer over 15-30 minutes.⁽¹⁰⁾ Infusion may be administered via drip tubing.⁽⁵⁾

INSTRUCTIONS FOR RECONSTITUTION:

IV injection: Reconstitute with water for injections, sodium chloride 0.9% or glucose 5%.⁽¹⁾ Reconstitute by adding 9.2mL of diluent to provide 100mg per 1mL.⁽¹⁾

IV infusion: Reconstitute as above. Requires further dilution before administration.⁽¹⁾

DISPLACEMENT VALUE:

0.8mL per 1g vial ⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

After reconstitution can be further diluted with any suitable volume of sodium chloride 0.9% or glucose 5%.⁽¹⁾

IV infusion: Diluting the 100mg per mL solution in 50-100mL of glucose 5% has been used.⁽¹¹⁾

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

24 hours at room temperature after dilution.⁽⁹⁾

FLUSHING:

IV injection: Flush with sodium chloride 0.9% or glucose 5%.⁽¹⁾

IV infusion: Flush with sodium chloride 0.9% or glucose 5%.⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Bone marrow depression, grey syndrome.⁽¹⁾

Dryness of the mouth, nausea and vomiting, diarrhoea, urticaria, optic neuritis with blurring or temporary loss of vision, peripheral neuritis, headache and depression.⁽¹⁾

Intensely bitter taste after rapid intravenous use.⁽²⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

Compatible (it is assumed that medicines meet close to the vascular access device): Aciclovir, esmolol, labetalol, magnesium sulphate, morphine sulphate.⁽⁴⁾ N.B. Compatibility information is based on chloramphenicol concentration of 10 or 20mg/mL in glucose 5%.
Incompatible: Fluconazole.⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

No additional precautions are required.⁽⁸⁾

SODIUM CONTENT (mmol):

3.14mmol in 1g.⁽⁵⁾

OSMOLARITY / OSMOLALITY:

100mg in 1mL water for injections has an osmolality of 533mOsm/kg.⁽⁴⁾

pH:

1g in 10mL water for injections has a pH of 6.4⁽¹²⁾

REFERENCES:

1. Summary of Product Characteristics, Kemicetine, last reviewed March 2009
2. Martindale 36th Edition accessed via <http://www.medicinescomplete.com> on 03/01/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 03/01/2012
4. Trissel "Handbook on injectable drugs" 16th Edition, pg 331
5. British National Formulary No. 62 September 2011, pg 363 and 957
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2nd Edition 2003, pg113-114
 - a) British National Formulary for Children 2011-2012 pg 284
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by Sigma-Aldridge, last revised 13/03/2010
9. Drug company name: Pfizer
Date contacted: 07/02/2012
10. Merck Drug Information provided by Lexi-Comp. Last reviewed May 2011.
Accessed on 17/02/2012 via <http://www.merck.com/mmpe/lexicomp/chloramphenicol.html>.
11. [Intravenous Medications: 28th Edition 2012; B Gahart, A Nazareno](#)
12. QA Department Charing Cross Hospital. Date contacted: 05/01/2012

Intravenous

Chlorphenamine maleate

MEDICINE NAME:

Chlorphenamine maleate
(Chlorpheniramine maleate)

TRADE NAME(S):

Generic (Archimedes Pharma)

PRESENTATION OF MEDICINE:

Ampoules containing chlorphenamine maleate 10mg in 1mL.⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: give slowly over at least one minute.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Can be diluted with sodium chloride 0.9% if necessary.⁽¹⁾

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

If diluted, use immediately.⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9%.⁽¹⁾⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

The most common side-effect is sedation varying from slight drowsiness to deep sleep.⁽¹⁾
Paradoxical excitation in children and confusional psychosis in the elderly can occur.⁽¹⁾
Some patients have reported a stinging or burning sensation at the site of injection.⁽¹⁾
Rapid intravenous injection may cause transitory hypotension or CNS stimulation.⁽¹⁾

EXTRAVASATION:

No information available⁽⁹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

In the absence of incompatibility studies this product must not be mixed with other medicinal products.⁽¹⁾

SODIUM CONTENT (mmol):

Information not available.⁽⁹⁾

pH:

4.0 to 5.2.⁽²⁾⁽⁴⁾

OTHER COMMENTS:

During storage protect from light.⁽¹⁾⁽⁴⁾

REFERENCES:

1. Summary of Product Characteristics, Chlorphenamine maleate, last updated 15/09/2008, eMC accessed August 2010
2. Martindale "The Complete Drug Reference" 2009 35th Edition, pg 516-517
3. American Hospital Formulary Service Drug Information
4. Trissel "Handbook on injectable drugs" 15th Edition pg 349-350
5. British National Formulary No. 59
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Archimedes Pharma UK Ltd
Date contacted: August 2010

Version 4

Intravenous

Ciprofloxacin

MEDICINE NAME:

Ciprofloxacin

TRADE NAME(S):

Ciproxin® (Bayer)
Ciprofloxacin (Hospira, Fannin, Claris, Fresenius Kabi)

PRESENTATION OF MEDICINE:

Bayer; Fannin; Claris:

Vials, bottles or bags containing ciprofloxacin 2mg in 1mL (as lactate) solution for infusion in the following presentations in sodium chloride 0.9%:

100mg in 50mL
200mg in 100mL
400mg in 200mL

Hospira; Mylan

Infusion bags containing ciprofloxacin 2mg in 1mL (as lactate) solution for infusion in the following presentations in glucose 5%:

100mg in 50mL
200mg in 100mL
400mg in 200mL

Fresenius Kabi

Infusion bags containing ciprofloxacin 2mg in 1mL (as hydrogen sulphate) solution for infusion in the following presentations in sodium chloride 0.9%

100mg in 50mL
200mg in 100mL
400mg in 200mL

METHOD OF ADMINISTRATION:

IV infusion (adults) Give at a rate of not more than 200mg in 30 minutes using an infusion pump.^(1a-f)

IV infusion (children): Give over 60 minutes using an infusion pump.^(1a-f)

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹⁴⁾ If a central venous access device is unavailable a risk benefit analysis should be made on an individual patient basis. If given peripherally, the insertion site must be monitored closely for phlebitis using a recognised infusion phlebitis scoring tool.⁽¹⁴⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5% ⁽³⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Anaphylaxis, nausea, diarrhoea, vomiting, rash, pruritus, urticaria, injection site reactions.^(1a-f)

Monitoring: Monitor for tendon inflammation or painful swelling. Discontinue if this reaction occurs and keep the affected limb at rest.⁽¹⁾

EXTRAVASATION:

Extravasation may cause tissue damage due to extreme pH.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusions (it is assumed that medicines meet close to the vascular access device): Amiodarone (in glucose 5%), anidulafungin, aztreonam (in glucose 5%), bivalirudin (in glucose 5%), calcium gluconate (in glucose 5%), caspofungin (in sodium chloride 0.9%), ceftazidime (in glucose 5%), cisatracurium (in glucose 5%), clarithromycin (in glucose 5%), digoxin, dobutamine, dopamine, doripenem, gentamicin, granisetron (in glucose 5%), lidocaine, linezolid (in glucose 5%), lorazepam (in sodium chloride 0.9%), metoclopramide, midazolam, potassium acetate (in glucose 5%), potassium chloride, ranitidine, tigecycline (in sodium chloride 0.9%), tobramycin (in glucose 5%), verapamil.⁽⁴⁾

Compatible with the following infusions: Glucose 5%, glucose 10%, Ringer's Solution for injection, sodium lactate, compound (Hartmann's), sodium chloride 0.9%. (1a-f)

Incompatible: Solutions unstable at pH 3.9 to 4.5.⁽¹⁾

Aminophylline, amoxicillin, benzylpenicillin, co-amoxiclav, dexamethasone, furosemide, heparin sodium, hydrocortisone sodium succinate, magnesium sulfate, methylprednisolone, pantoprazole sodium succinate, phenytoin sodium, propofol, sodium bicarbonate, sodium phosphate, teicoplanin.⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

No information available ⁽⁸⁾

SODIUM CONTENT (mmol):

Bayer; Claris; Fannin and Fresenius Kabi

7.7mmol in 50mL solution for infusion.^{(1a-b)(1d-e)}

Hospira; Mylan

Negligible as formulated in glucose 5%

(NB contains 45-50g of glucose per litre).^{1c)(1f)}

OSMOLARITY / OSMOLALITY:

Bayer; Fannin

276 - 318mOsmol/kg (in 100mL sodium chloride 0.9%).^{(1a)(1e)}

Fresenius Kabi; Claris

300 - 316mOsmol/L (in sodium chloride 0.9%).^{(1b)(1d)}

pH:

pH 3.5 to 4.9 ^(1a-f)

OTHER COMMENTS:

1. Contains lactic acid 20% w/v.⁽¹⁾
2. Patients should avoid prolonged exposure to strong sunlight or UV radiation during treatment.⁽¹⁾
3. Keep vials/bottles/infusion bag in their carton/over pouch until ready to use in order to protect from light.⁽¹⁾
4. Do not refrigerate.⁽¹⁾ At cool temperatures precipitation may occur which will redissolve

at room temperature (15-25°C). Do not use if crystals are present.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Ciproxin® last revised 01/09/2011
 - b) Ciprofloxacin, Fresenius Kabi last revised February 2011
 - c) Ciprofloxacin, Hospira last revised January 2008
 - d) Ciprofloxacin, Claris Lifesciences last revised February 2011
 - e) Ciprofloxacin, Fannin last revised September 2010
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com on 16/04/2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 16/04/2012
4. Trissel "Handbook on injectable drugs" 16th Edition accessed via www.medicinescomplete.com on 17/04/2012
5. British National Formulary No. 63, March 2012 pg 388
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-12
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer (Bayer Pharmaceuticals, November 2010)
9. Drug company name: Bayer Pharmaceuticals. Date contacted: 24/02/2012
10. Drug company name: Fresenius Kabi. Date contacted: 03/04/2012
11. Drug company name: Hospira UK Ltd. Date contacted: 13/03/2012
12. Drug company name: Claris Lifesciences. Date contacted: 09/03/2012
13. Drug company name: Noridem Enterprises Ltd via Fannin (UK) Ltd. Date contacted: 01/03/2012
14. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 4

Intravenous

Clarithromycin

MEDICINE NAME:

Clarithromycin

TRADE NAME(S):

Klaricid IV[®]

Generic (Ibigen Srl; Mercury; Teva UK; Martindale; Strides (agila))

PRESENTATION OF MEDICINE:

Glass vial containing 500mg Powder for Solution for Injection ^(1a-f)

METHOD OF ADMINISTRATION (adult):

IV infusion: via a large peripheral vein over at least 60 minutes. ^{(1a-f)(6a)}

Do not administer by IV injection or by intramuscular injection. ^{(1a-d)(4)}

INSTRUCTIONS FOR RECONSTITUTION (adult):

Reconstitute vial using 10mL water for injections and shake to dissolve the contents. ^(1a-f)

DISPLACEMENT VALUE:

Klaricid[®] (Abbott): 0.4mL - Each 500mg vial contains 520mg. Final solution is equivalent to 500mg in 10mL. ^(9a)

Clarithromycin (Ibigen Srl, Martindale) - 0.75mL - Each 500mg vial made up with 10mL water for injections, final volume = 10.75mL. ^{(9b)(9d)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

Dilute to 2mg per mL with 250mL of glucose 5% or sodium chloride 0.9%. ^(1a-f)

STABILITY

Prepare immediately before use. Use within 6 hours once diluted in 250mL of appropriate diluent ⁽¹⁾⁽⁴⁾

FLUSHING:

Flush with 5% glucose or 0.9% sodium chloride.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Injection site inflammation, tenderness, phlebitis and pain. ^(1a-f)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible with the following infusions (it is assumed that medicines mix close to the vascular access device): Amiodarone (only in glucose 5% - NOTE: clarithromycin should also be in glucose 5%), amoxycillin sodium-clavulanate potassium, ampicillin, atracurium, benzylpenicillin, bumetanide, ciprofloxacin, dobutamine, dopamine, gentamicin, human insulin, lidocaine hydrochloride, metoclopramide, metronidazole, potassium chloride, ranitidine, ticarcillin disodium-clavulanate potassium (in glucose 5% - NOTE: clarithromycin should also be in glucose 5%), vancomycin, vecuronium. ⁽⁴⁾

Compatible with the following infusion fluids: Glucose 5% in sodium chloride 0.45%, ⁽⁴⁾
Ringer's solution, sodium lactate, compound (Hartmann's), ^(1c-f)

Incompatible: Aminophylline, ceftazidime, cefuroxime, furosemide, flucloxacillin, heparin, phenytoin sodium.⁽⁴⁾

SODIUM CONTENT (mmol):

Zero ^(9b)

OSMOLARITY / OSMOLALITY:

No information ^(9a-d)

pH:

pH 4.5 to 6.0 ^{(9a)(9c-d)}

OTHER COMMENTS:

1. IV route not licensed for children.^(6a)
2. Excipients: vial contains lactobionic acid and sodium hydroxide EP.^(1a-f)

REFERENCES:

1. Summary of Product Characteristics
 - a) Klaricid IV (package insert), Abbott Laboratories, last revised February 2013
 - b) Clarithromycin, MAH: Ibigen Srl and Distributor: Bowmed Ibisqus Ltd . Last revised 04/04/2011
 - c) Clarithromycin. Teva UK Ltd. Date last revised 17/06/2011
 - d) Clarithromycin, Martindale Pharmaceuticals. Date last revised 05/03/2010
 - e) Amdipharm Mercury company ltd (Mercury product), last revised 17/12/2012
 - f) Co-Pharma Ltd (Strides (Agila) product), last revised 12/03/2012
2. Martindale accessed via <http://www.medicinescomplete.com> on 13/07/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 15/08/2012
4. Trissel "Handbook on Injectable Drugs" 16th Edition accessed via <http://www.medicinescomplete.com> on 13/07/2012
5. British National Formulary No. 63 accessed via <http://www.bnf.org/bnf/> on 13/07/2012
6. Medicines for Children produced by the Royal College of Paediatric & Child Health August 2003 pg 133
 - a) British National Formulary for Children 2011-2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. MSDS report compiled by the manufacturer
9.
 - a) Drug company name: Abbott Laboratories. Date contacted: 15/07/2012
 - b) Drug company name: Bowmed Ibisqus Ltd (supplies Ibigen Srl product). Date contacted: 15/7/2012
 - c) Drug company name: Teva UK Ltd. Date contacted: 15/7/2012
 - d) Drug company name: Martindale Pharmaceuticals. Date contacted: 15/7/2012
10. www.accessabilitybybard.co.uk accessed 15/08/2012

Version 7 (NHS Lothian local amendment)

Intravenous

Clindamycin

MEDICINE NAME:

Clindamycin

TRADE NAME(S):

Dalacin C® phosphate
Generic (Bowmed Ibisqus Ltd, Focus Pharmaceuticals)

PRESENTATION OF MEDICINE:

Ampoules containing 300mg in 2mL (as phosphate). Concentrate for dilution.^(1a-c)
Ampoules containing 600mg in 4mL (as phosphate). Concentrate for dilution.^(1a-c)

METHOD OF ADMINISTRATION:

Do not administer by IV injection.^{(1a)(3)(4)}

IV infusion: Administer each 300mg over at least 10 minutes.^(1a-c)

Infusion rates should not exceed 30mg per minute.^(1a-c)

Administration of more than 1.2g in a single 1 hour infusion is not recommended.^(1a-c)

Maximum rate in paediatrics is 20mg/kg over 1 hour.^{(6)(6a)}

IV continuous infusion: Doses over 1.2g should be given by continuous infusion.⁽⁵⁾

Continuous intravenous infusions may begin with a single rapid infusion of the first dose (generally over 30minutes), followed by a continuous infusion of 0.75 to 1.25mg/minute.⁽²⁾⁽⁴⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Requires further dilution before administration.^(1a-c)

Dilute 300mg and 600mg doses with 50mL, 900mg with 50-100mL and 1200mg with 100mL of glucose 5% or sodium chloride 0.9%.^(1a-c)

The concentration of clindamycin once diluted should not exceed 18mg in 1mL.^(1a-c)

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

24 hours at room temperature after dilution.^(1a-c)

FLUSHING:

IV infusion: Flush with sodium chloride 0.9% or glucose 5%.^(1a-c)

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Thrombophlebitis.^(1a-c) Local reactions can be minimised by giving deep IM injections or avoiding the prolonged use of indwelling IV catheters.^(1a-c)

Rare cases of cardiopulmonary arrest and hypotension following too rapid intravenous administration.^(1a-c)

N.B. Generics do not contain benzyl alcohol as an excipient.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Clindamycin infusion is compatible with the following infusions (it is assumed that medicines meet close to the vascular access device): Aciclovir, amiodarone, esmolol, granisetron, labetalol, morphine sulphate, propofol, remifentanyl, Tazocin®.⁽⁴⁾

Incompatible: Ampicillin, aminophylline, barbiturates, calcium gluconate, ceftriaxone, ciprofloxacin, idarubicin, magnesium sulphate, phenytoin, ranitidine.^(1a-c) Allopurinol, doxapram, fluconazole.⁽⁴⁾

NB. Compatibility information is based on clindamycin concentration of 6-24mg/mL in glucose 5% or sodium chloride 0.9%.

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

SPECIAL HANDLING PRECAUTIONS:

No additional precautions are required.⁽⁸⁾

SODIUM CONTENT (mmol):

Not significant,^{(9b)(9c)} varies from batch to batch.^(9a)

OSMOLARITY / OSMOLALITY:

600mg in 50mL glucose 5% has an osmolality of 293mOsm/kg.⁽¹⁰⁾

pH:

600mg in 5mL glucose 5% has a pH of 6.4.⁽¹¹⁾

OTHER COMMENTS:

1. Do not store above 25°C.^(1a-c) Do not refrigerate or freeze.^(1a-c)

REFERENCES:

1. Summary of Product Characteristics
 - a) Dalacin C Phosphate, last revised May 2010
 - b) Clindamycin 150mg/mL solution for injection, MAH: Villerton Invest SA distributed by Bowmed Ibisqus Ltd. Last revised 31/10/2011
 - c) Clindamycin 150mg/mL solution for injection, Focus Pharmaceuticals. Last revised September 2011
2. Martindale accessed via <http://www.medicinescomplete.com> on 09/12/2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 09/12/2011
4. Trissel "Handbook on injectable drugs" 16th Edition 2010 pg 395-406
5. British National Formulary No. 62, September 2011 pg 362-363 and 957
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012 pg 283-284
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by Pfizer, last revised 15/12/2006
9.
 - a) Drug company name: Pfizer (Pharmacia Ltd). Date contacted: 20/07/2010
 - b) Drug company name: Bowmed Ibisqus Ltd. Date contacted: 20/12/2011
 - c) Drug company name: Focus Pharmaceuticals. Date contacted: 20/12/2011
10. AccessAbility Programme, accessed via www.accessabilitybybard.co.uk accessed on 20/12/2011

11. Charing Cross Hospital QA Department, contacted 05/01/2012

Version 5

Intravenous

Clonazepam

October 2013: Clonazepam 1mg/1mL discontinued

MEDICINE NAME:

Clonazepam

TRADE NAME(S):

Rivotril®

PRESENTATION OF MEDICINE:

Ampoule containing clonazepam 1mg in 1mL. Plus 1mL ampoule containing water for injections as a diluent.⁽¹⁾

METHOD OF ADMINISTRATION (adult):

IV injection:

ADULT: Give by slow IV injection (the rate should not exceed 0.25mg -0.5mg per minute) into a large vein such as the antecubital fossa.⁽¹⁾⁽²⁾⁽⁵⁾

CHILD and NEONATE: Give by slow IV injection over at least 2 minutes.^(6a) Avoid in neonates unless there is no safer alternative available (see 'other comments').^(6a)

Intravenous infusion: Ideally should be infused over no longer than 2 hours.⁽¹⁾ Adjust the rate of infusion to patient's response.⁽¹⁾ Administer using an infusion pump.

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹¹⁾ If a central venous access device is unavailable a risk benefit analysis should be made on an individual patient basis. If given peripherally the insertion site should be monitored closely for phlebitis using a recognised infusion phlebitis scoring tool.⁽¹¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

IV injection: Add the contents of the diluent ampoule (i.e. 1mL water for injections) to the contents of the other ampoule (i.e. 1mg clonazepam in 1mL) **immediately** before using the injection.⁽¹⁾

IV infusion:

ADULT: Up to a maximum 3mg clonazepam may be diluted in 250mL sodium chloride 0.9% or glucose 5% (i.e. maximum concentration 12micrograms in 1mL).⁽¹⁾

CHILD: Dilute to a maximum concentration of 12micrograms in 1mL with sodium chloride 0.9% or glucose 5%.^(6a)

When preparing an infusion it is not necessary to first dilute the ampoule contents with the diluent (water for injections) provided in the package.⁽⁹⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Muscle weakness, dizziness, ataxia, light headedness, occasional muscular hypotonia, co-ordination disturbances and respiratory depression.⁽¹⁾

Monitor EEG, blood pressure and respiratory function continuously during administration.

Immediate access to resuscitation equipment required.⁽¹⁾⁽⁵⁾

EXTRAVASATION:

Extravasation may cause tissue damage as the pH of the prepared injection is 3.4-4.3 and it contains ethanol and propylene glycol as excipients. If extravasation occurs refer to local treatment policies.⁽¹⁾⁽⁹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not mix with any other medicines or infusion fluids⁽⁴⁾

When giving by IV injection do not administer via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

Other compatible infusion fluids: Glucose 10% or sodium chloride 0.45% and glucose 2.5% injection.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

No information⁽⁸⁾

SODIUM CONTENT (mmol):

Nil⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information⁽⁹⁾

pH:

pH - 3.4 to 4.3⁽⁹⁾

OTHER COMMENTS:

1. Infusion dilution should be freshly prepared and used immediately if prepared in a glass container. If prepared in a PVC infusion bag the infusion should be completed within 2 hours.⁽¹⁾
2. The rate of administration must not exceed 0.5mg per minute. This will greatly diminish the rare possibility of hypotension or apnoea occurring.⁽¹⁾
3. Storage - Protect from light and below 30°C.⁽¹⁾
4. Excipients in active substance ampoule: ethanol absolute, glacial acetic acid, benzyl alcohol, propylene glycol, nitrogen pure.⁽¹⁾
5. Facilities for resuscitation should always be available.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Ritrovil® ampoules. Roche Product Ltd. Date of revision of text January 2013
2. Martindale accessed via <http://www.medicinescomplete.com> on 07/06/2013
3. American Hospital Formulary Service Drug Information 2010 accessed via <http://www.medicinescomplete.com> on 07/06/2013
4. Trissel "Handbook on injectable drugs" 15th Edition accessed via <http://www.medicinescomplete.com> on 07/06/2013
5. British National Formulary No. 64 March 2013 pg 299 and 675

6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by manufacturer updated 31/01/2011
9. Drug company name: Roche Products Ltd; Date contacted: 09/12/2011, 17/12/2013
10. www.extravasation.org.uk accessed online 10/01/2012
11. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 4

Intravenous

Co-amoxiclav

Contains a PENICILLIN.

MEDICINE NAME:

Co-amoxiclav

TRADE NAME(S):

Augmentin®
Generic (Ibigen Srl, Pliva, Wockhardt)

PRESENTATION OF MEDICINE:

Augmentin®

Vials containing co-amoxiclav 600mg powder for reconstitution.

Vials containing co-amoxiclav 1.2g powder for reconstitution.^(1a)

Generic co-amoxiclav preparations

Vials containing co-amoxiclav 500mg/100mg powder for reconstitution.

Vials containing co-amoxiclav 1000mg/200mg powder for reconstitution.^(1b-d)

Note: Augmentin® and generic products are of equivalent strength, but the strength is expressed differently.

Augmentin® 600mg = co-amoxiclav 500mg/100mg. Each vial contains 500mg amoxicillin (as amoxicillin sodium) and 100mg clavulanic acid (as potassium clavulanate).

Augmentin® 1.2g = co-amoxiclav 1000mg/200mg. Each vial contains 1000mg amoxicillin (as amoxicillin sodium) and 200mg clavulanic acid (as potassium clavulanate).

METHOD OF ADMINISTRATION (adult):

IV injection: Administer over 3-4 minutes.⁽¹⁾

IV infusion: Administer over 30-40 minutes.⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION (adult):

Reconstitute 600mg (500/100mg) with 10mL water for injections.⁽¹⁾

Reconstitute 1.2g (1000/200mg) with 20mL water for injections.⁽¹⁾

A transient pink colouration may develop during reconstitution. Reconstituted solutions are normally colourless or a pale straw colour.⁽¹⁾

DISPLACEMENT VALUE:

Augmentin®, Pliva and Wockhardt generic products: 600mg (500/100mg) = 0.5mL. 1.2g (1000/200mg) = 0.9mL.^(1a, 1c-d)

Ibigen srl product: 500/100mg = 0.4mL. 1000/200mg = 0.7mL.^(1b)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

ADULT

IV infusion: Add the 600mg (500/100mg) reconstituted solution to 50mL and 1.2g (1000/200mg) reconstituted solution to 100mL of sodium chloride 0.9%.⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Contraindicated in penicillin hypersensitivity. Always check for previous hypersensitivity reactions to penicillins, cephalosporins and other allergens before starting therapy.⁽¹⁾
Hypersensitivity reactions. Thrombophlebitis at the site of injection.⁽¹⁾

EXTRAVASATION:

No information available.⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

If co-amoxiclav is prescribed concurrently with an aminoglycoside, the antibiotics should not be mixed in the syringe, intravenous fluid container or giving set because loss of activity of the aminoglycoside can occur under these conditions.⁽¹⁾

Compatible infusions (it is assumed that medicines meet close to the vascular access device): Sodium chloride 0.9%, sodium lactate.

Augmentin®, co-amoxiclav (Ibigen Srl) may be infused with sodium lactate infusion BP, compound sodium chloride injection (Ringer's), compound sodium lactate infusion BP (Ringer-Lactate: Hartmann's), potassium chloride and sodium chloride infusion BP.^(1a,b)

Incompatible infusions: Glucose (all strengths).^(1a)

SODIUM CONTENT (mmol):

Augmentin®, Pliva & Ibigen Srl generic products:

600mg (500/100mg) contains 1.4mmol sodium and 0.5mmol of potassium.

1.2g (1000/200mg) contains: 2.7mmol of sodium, and 1mmol of potassium.^{(1a-c)(6a)}

Wockhardt generic product:

600mg (500/100mg) contains: 1.4mmols of sodium and 0.5mmols of potassium.

1.2g (1000/200mg) contains: 3.1mmol of sodium and 1mmol of potassium.^(1d)

OSMOLARITY / OSMOLALITY:

Ibigen Srl: Osmolarity of co-amoxiclav 10% solution is 512mOsmol/L.^(9b) No other information available.

pH:

Reconstituted solution pH 8 to 10.⁽⁹⁾

OTHER COMMENTS:

1. NOT SUITABLE FOR IM ADMINISTRATION.
2. Do not store above 25°C.

REFERENCES:

1. Summary of Product Characteristics
 - a) Augmentin® last revised 21/05/2013
 - b) Co-amoxiclav (Ibigen srl (supplier Bowmed Ibisqus Ltd, last revised 26/06/2012
 - c) Co-amoxiclav (Teva, PLIVA), last revised 07/04/2011
 - d) Co-amoxiclav (Wockhardt UK) last revised 20/04/2012

2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com>, 11/03/2010
3. American Hospital Formulary Service Drug Information, April 2010 update
4. Trissel "Handbook on injectable drugs" 15th Edition
5. British National Formulary No. 64 September 2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by manufacturer
9.
 - a) Drug company name: GlaxoSmithKline UK. Date contacted: 20/12/2011
 - b) Drug company name: Bowmed Ibisqus Ltd (MAH: Bowmed Ltd). Date contacted: 19/09/2011, 02/2010, 22/07/2013
 - c) Drug company name: Pliva Pharma Ltd. Date contacted: 13/09/2011
 - d) Drug company name: Wockhardt UK. Date contacted: 19/09/2011
10. www.extravasation.org.uk

Version 5

Intravenous

Colistin (colistimethate sodium)

Some information in this monograph is brand specific. Ensure you refer to the correct information for the brand used in your area.

MEDICINE NAME:

Colistin
(colistin sulphomethate sodium, colistimethate sodium)

TRADE NAME(S):

Colomycin®
Promixin®

PRESENTATION OF MEDICINE:

Colomycin® and Promixin®: Each vial contains 1,000,000 (1million) international units colistimethate sodium as powder for solution for injection.^{(1a)(1b)}

Colomycin®: Each vial contains 2,000,000 (2million) international units colistimethate sodium as powder for solution for injection.^(1a)

METHOD OF ADMINISTRATION:

IV injection: Patients fitted with a totally implantable venous access device may tolerate a bolus injection given over a minimum of 5 minutes.^{(1a)(1b)}

IV infusion: Dilute dose further in a suitable volume and administer over 30 minutes.^{(1a)(1b)(5)}

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute with 10mL sodium chloride 0.9% or water for injections to form a clear solution.
^{(1a),(1b),(9a)(9b)} Roll vial in hand to reconstitute. Do not shake to avoid foam formation.^{(9a),(9b)}

DISPLACEMENT VALUE:

Colomycin®: negligible^(9a)
Promixin®: no information available^(9b)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Sodium chloride 0.9% (Colomycin® and Promixin®).^{(1a)(1b)}
Glucose 5% (Promixin®).^(1b)

For IV infusion: For adults dilute to 50mL.^{(1a)(1b)(5)} For children dilute to a final concentration of 40,000units/mL.^(6a)

STABILITY

Prepare immediately before use.

FLUSHING:

Sodium chloride 0.9%^{(1a)(1b)}

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypersensitivity reactions, including rash ⁽⁵⁾ and injection site reactions ^{(1a)(1b) (5)}

Plasma level monitoring is recommended for patients with cystic fibrosis (CF) or renal impairment. ^{(1a)(1b)(2)(5)} However in practice serum levels are not routinely taken in CF patients.

EXTRAVASATION:

No information available

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not routinely infuse with any other medicines. Refer to pharmacy for further advice.

Incompatible:

Erythromycin, tetracycline ^(1b)

Other compatible diluents: include Ringer's solution, ^(1b) glucose 5% and sodium chloride 0.45%, glucose 5% and sodium chloride 0.9%, compound sodium lactate. ⁽³⁾

SODIUM CONTENT (mmol):

Less than 0.5mmol per vial before reconstitution ⁽⁵⁾

OSMOLARITY / OSMOLALITY:

No information available. ^{(9a)(9b)}

pH:

pH 6.5 TO 8.5 ^{(8a)(8b)}

OTHER COMMENTS:

1. Concomitant use of colistimethate sodium with other medicinal products of neurotoxic and/or nephrotoxic potential should be avoided. ^{(1a)(1b)}

REFERENCES:

1. a) Summary of Product Characteristics, Colomycin injection, Forest Laboratories UK Ltd. eMC last updated December 2009
b) Summary of Product Characteristics, Promixin 1MIU powder for solution for injection, Profile Pharma Ltd. eMC last updated 13th March 2009
2. Martindale accessed via <http://medicinescomplete.com> on 13th January 2010
3. American Hospital Formulary Service Drug Information" accessed via <http://medicinescomplete.com> on 13th January 2010
4. Trissel "Handbook on injectable drugs" accessed via <http://medicinescomplete.com> on 13th January 2010
5. British National Formulary No. 58 September 2009 accessed via www.bnf.org.uk on 15th

- January 2010
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2009 accessed via www.bnf.org.uk/bnfc on 15th January 2010
 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
 8. COSHH report compiled by manufacturer
 - a) Forest Laboratories UK Ltd 05/04/04
 - b) Profile pharma Ltd 9/12/05
 9. a) Drug company name: Forest Laboratories UK Ltd, Dates contacted: February 2008, July 2009, January 2010
 - b) Drug company name: Profile Pharma Ltd, Dates contacted: June 2008, July 2009, January 2010

Version 1 (NHS Lothian local amendment)

Intravenous

Iron dextran (Cosmofer)

The MHRA issued updated advice (see 'Method of Administration' below) on administration and monitoring of intravenous iron preparations dated August 2013 which is included in this monograph but may not be reflected in the package insert.

MEDICINE NAME:

Iron dextran

TRADE NAME(S):

Cosmofer® (Vitaline Pharmaceuticals UK Ltd)

PRESENTATION OF MEDICINE:

Ampoules containing 100mg iron (as dextran) in 2mL.
Ampoules containing 250mg iron (as dextran) in 5mL.
Ampoules containing 500mg iron (as dextran) in 10mL.
Each mL contains 50mg iron (as dextran).

METHOD OF ADMINISTRATION (adult):

Before administering the first dose to a new patient a **test dose** of iron dextran (25mg) must be administered. If no adverse reactions are seen after **60 minutes**, the remaining dose can be given. Anaphylactoid reactions are usually evident within a few minutes, therefore, close observation of the patient is necessary.⁽¹⁾

If there any signs of hypersensitivity or intolerance, stop immediately.⁽¹⁾

IV infusion, via an infusion pump (preferred method): on each occasion infuse 25mg as a test dose.⁽¹⁾ Withdraw a volume containing the test dose (25mg) from the prepared iron dextran (Cosmofer®) infusion and administer over 15 minutes via a syringe pump. Observe the patient for 60 minutes. If no adverse reactions occur administer the remaining portion of the infusion at a rate of not more than 100mL in 30 minutes.

For subsequent doses, the first 25mg should be infused over a period of 15 minutes. If no adverse reactions occur during this time the remaining portion can be infused at an infusion rate of not more than 100mL in 30 minutes.⁽¹⁾

IV injection (alternative method): On each occasion administer 25mg by slow intravenous injection over 1 to 2 minutes as a test dose.⁽¹⁾ Observe the patient for 60 minutes. If no adverse reactions occur administer the remainder of the injection.

For subsequent doses, on each occasion, administer a test dose of 25mg slowly over a period of 1 to 2 minutes. If no adverse reactions occur within 15 minutes, the remaining portion of the injection may be administered.⁽¹⁾

Total dose IV infusion, (hospital use only because of an increased incidence of adverse reactions): initially infuse 25mg as a test dose. Withdraw a volume containing the test dose (25mg) from the prepared iron dextran (Cosmofer®) infusion and administer over 15 minutes via a syringe pump. Observe the patient. If no adverse reactions occur restart and complete the remainder of the infusion at a rate not exceeding 5mg per kg per hour. Observe the patient during the infusion and for at least one hour after completion of the infusion.⁽¹⁾

IM injection is the preferred route for patients with asthma, allergic disorders and inflammatory disorders.⁽¹⁾

New advice from the MHRA: Recommendations to manage and minimise risk of serious hypersensitivity reactions. Issued August 2013. See link below

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

For **IV infusion** dilute 100-200mg iron dextran in 100mL of sodium chloride 0.9% or glucose 5% to give a final concentration of 1-2mg iron dextran per mL.⁽¹⁾

For **IV injection** dilute 100-200mg iron dextran in 10-20mL sodium chloride 0.9% or glucose 5% to give a final concentration of 10-20mg iron dextran per mL.⁽¹⁾

For **total dose infusion** add required dose, immediately before administration, to 500mL sodium chloride 0.9% or glucose 5%.⁽¹⁾⁽²⁾

Sodium chloride 0.9% is preferable to glucose 5% as a diluent due to lower incidence of thrombophlebitis⁽²⁾

The reconstituted solution for infusion and injection is to be visually inspected prior to use. Only clear solutions without particles should be used.⁽¹⁾

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

Chemical and physical in-use stability has been demonstrated for 24 hours at 25°C.⁽¹⁾

FLUSHING:

Sodium chloride 0.9% and glucose 5%.⁽¹⁾⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Observe patients closely during and for at least one hour after IV administration.⁽²⁾
2. Iron dextran can cause anaphylactoid reactions including urticaria, rashes, itching, nausea and shivering. Administration must be stopped immediately when signs of an anaphylactoid reaction are observed.⁽¹⁾
3. Acute, severe anaphylactoid reactions are very rare. They usually occur within the first few minutes of administration and are generally characterised by the sudden onset of respiratory difficulty and/or cardiovascular collapse; fatalities have been reported. Facilities for cardiopulmonary resuscitation including adrenaline (1:1000) must be available; risk of allergic reactions increased in immune or inflammatory conditions.⁽¹⁾⁽⁵⁾ Additional treatment with antihistamines and/or corticosteroids should be given as appropriate.⁽¹⁾
4. Rapid IV administration may be associated with vascular flushing and hypotension.⁽¹⁾⁽²⁾. Thrombophlebitis may occur at the site of injection, although the incidence can be reduced by giving iron dextran in sodium chloride 0.9% rather than glucose 5%.⁽²⁾
5. Large doses of iron dextran (5mL or more) have been reported to give a brown colour to serum from a blood sample drawn four hours after administration.⁽¹⁾

EXTRAVASATION:

No information ⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or infusions.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

The intramuscular and subcutaneous injection of iron-carbohydrate complexes in very large doses under experimental conditions in animals produced sarcoma in rats, mice, rabbits, possibly hamsters but not in guinea pigs. Cumulative information and independent assessment indicate that the risk of sarcoma formation in man is minimal.⁽¹⁾⁽⁸⁾

SODIUM CONTENT (mmol):

1.7mmol in 50mg/mL iron dextran⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Iron dextran - 290.8 - 423mOsm/. See link.

pH:

5.2 - 6.5⁽²⁾⁽³⁾⁽⁹⁾

OTHER COMMENTS:

Store ampoules of iron dextran at 15-30°C.⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics, Cosmofer 50mg/mL solution for infusion and injection; last updated September 2009
2. Martindale accessed via <http://www.medicinescomplete.com> on 17 March 2010
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 17 March 2010
4. Trissel "Handbook on injectable drugs" 15th Edition accessed via <http://www.medicinescomplete.com> on 17 March 2010
5. British National Formulary No. 59, March 2010 pg 557
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003
a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. Material Safety Data Sheet compiled by Pharmacosmos A/S
9. Drug company name: Vitaline Pharma UK Ltd - Contacted: January 2010
10. www.extravasation.org.uk accessed on 17 March 2010

Version 2.1

Intravenous

Co-trimoxazole

MEDICINE NAME:

Co-trimoxazole

TRADE NAME(S):

Seprin® for Infusion (Laboratoires Genopharm)

PRESENTATION OF MEDICINE:

Ampoules containing 480mg (80mg trimethoprim plus 400mg sulfamethoxazole) in 5mL.⁽¹⁾

METHOD OF ADMINISTRATION:

IV infusion: After diluting appropriately, administer the required dose over 60-90 minutes using an infusion pump.⁽¹⁾⁽²⁾⁽⁴⁾⁽⁵⁾ Administration via a central venous access device is the preferred route of administration. If this is not possible a large peripheral vein should be used.

Must not be given by rapid IV injection.⁽¹⁾⁽⁴⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Preferred method of dilution:

Dilute each 5mL ampoule with 125mL of glucose 5% or sodium chloride 0.9% ⁽¹⁾⁽²⁾⁽⁴⁾ e.g.

1 x 5mL ampoule to 125mL

2 x 5mL ampoules to 250mL

3 x 5mL ampoules to 500mL

Dilution in fluid restriction:

A 5ml (480mg) ampoule can be diluted with 75mL of glucose 5% and the total infusion given over a maximum of 60 minutes ⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾⁽⁵⁾. Dilutions which result in higher concentrations than this have been shown to be unstable and are not recommended ⁽⁴⁾.

High dose co-trimoxazole has been given undiluted through a central line (mainly in critical care setting). Each dose is given over 1.5 to 2 hours.⁽¹²⁾ This is not recommended by the manufacturer.

After adding co-trimoxazole to the infusion solution, shake thoroughly to ensure complete mixing. If visible turbidity or crystallisation appears at anytime before or during an infusion, the mixture should be discarded.⁽¹⁾

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Use diluted infusions within 4-6 hours.⁽²⁾⁽⁴⁾ Concentrated infusions (i.e. 5mL diluted to 75mL) should be used within 2 hours.⁽⁴⁾

FLUSHING:

Flush with sodium chloride 0.9% ⁽¹⁾ or glucose 5% ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Local pain and irritation, inflammation, and rarely thrombophlebitis may occur, especially if extravascular infiltration of the drug occurs.⁽³⁾ Slowing the rate of infusion may avoid nausea and vomiting.⁽¹⁰⁾

Seprin for Infusion contains sulphite. This may cause allergic type reactions including

anaphylactic symptoms and life threatening or less severe asthmatic episodes in susceptible individuals.⁽¹⁾

EXTRAVASATION:

May cause tissue damage leading to thrombophlebitis at site of infusion and localised pain and irritation during infusion.⁽¹⁰⁾

Due to a high pH and high osmolarity of co-trimoxazole solution a central line is a preferred route of administration. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

The standard infusion (i.e. each 5ml ampoule diluted with 125ml) is compatible with the following diluents: Glucose 5% or 10%,⁽¹⁾ sodium chloride 0.9%,⁽¹⁾ sodium chloride 0.18% and glucose 4%,⁽¹⁾ Dextran 70 injection BP (6% w/v) in glucose 5% or 0.9% sodium chloride,⁽¹⁾ Ringer's solution for injection⁽¹⁾

NOTE: for more concentrated infusion ie. 5mL co-trimoxazole in 75mL infusion, only glucose 5% should be used.⁽¹⁾⁽³⁾⁽⁴⁾

Incompatible: Do not infuse with any other medicines or infusions.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

None.⁽¹⁾⁽⁸⁾

SODIUM CONTENT (mmol):

1.7mmol⁽¹⁾ per 480mg vial.

OSMOLARITY / OSMOLALITY:

833mOsm/kg (in 9.6mg/mL in 0.9% sodium chloride)⁽⁴⁾

798mOsm/kg (in 9.6mg/mL in glucose 5%)⁽⁴⁾

541mOsm/kg (in 4.8mg/mL in glucose 5%)⁽¹⁰⁾

pH:

pH approximately 9.5 to 10.5.⁽³⁾⁽⁴⁾⁽⁹⁾

OTHER COMMENTS:

1. More stable in glucose 5% than sodium chloride 0.9%.⁽³⁾⁽⁴⁾
2. Infusions should be prepared immediately before use⁽¹⁾ and not refrigerated.⁽³⁾
3. This medicinal product contains 13.2 vol% ethanol (alcohol), i.e. up to 521 mg per dose. This is equivalent to 2.64 ml of beer, or 1.1 ml of wine. Harmful for those suffering from alcoholism. To be taken into account in pregnant or breast-feeding women, children and high-risk groups such as patients with liver disease, or epilepsy.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Septrin for infusion, last updated 31 July 2009
2. Martindale "The Complete Drug Reference", accessed via <http://www.medicinescomplete.com> on 31/12/2009
3. American Hospital Formulary Service Drug Information 2009, accessed via <http://www.medicinescomplete.com> on 31/12/2009
4. Trissel "Handbook on injectable drugs", accessed via

- <http://www.medicinescomplete.com> on 31/12/2009
5. British National Formulary No. 58, September 2009 (online version)
 6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2009
 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
 8. COSHH report compiled by manufacturer December 2009
 9. Drug company name: Glaxo SmithKline. Date contacted: December 2009
 10. www.extravasation.org.uk
 11. www.accessabilitybybard.co.uk
 12. UKCPA: Minimum infusion volumes for fluid restricted critically ill patients, 2006, version 3.

Version 5

Intravenous

Cyclizine

MEDICINE NAME:

Cyclizine

TRADE NAME(S):

Valoid® (Amdipharm), Cyclizine (Martindale Pharma)

PRESENTATION OF MEDICINE:

Ampoules containing cyclizine lactate 50mg in 1mL (not cyclizine base).⁽¹⁾

METHOD OF ADMINISTRATION:

Intravenous injection: Give slowly over at least 3-5 minutes.⁽¹⁾ (See 'Dilution and Diluents' section).

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹³⁾ If given peripherally the insertion site should be monitored for chemical phlebitis using a recognised infusion phlebitis scoring tool (in line with all medicines administered peripherally).⁽¹³⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Cyclizine is extremely irritant and causes pain on injection. Dilution with a small volume of diluent may reduce the pain and enable the injection to be delivered slowly at the recommended rate of 3-5 minutes to reduce the incidence of adverse effects.⁽¹¹⁾

Cyclizine can be further diluted with 5 to 10mL of sodium chloride 0.9% (unlicensed)⁽¹¹⁾⁽¹²⁾ - see 'other comments' section below - or glucose 5%.⁽¹⁾⁽⁴⁾⁽¹¹⁾

Immediately after dilution, and again just before injection, check the solution for signs of precipitation. Discard if there is any cloudiness or haze formation.⁽¹¹⁾ Cyclizine should be administered as soon as possible after dilution.

STABILITY

Prepare immediately before use.

FLUSHING:

Sodium chloride 0.9% or glucose 5%.⁽¹¹⁾⁽¹²⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Cyclizine is extremely irritant and can cause injection site reactions include vein tracking, erythema, pain and thrombophlebitis.⁽¹⁾⁽⁹⁾

Diluting the injection before giving may help reduce pain.

There have been cases of onset of paralysis following administration that usually fully resolve within hours of discontinuation of the medicine.⁽¹⁾

Other reported adverse reactions include: Hypotension, tachycardia, palpitations, drowsiness, headache, dry mouth, blurred vision, urinary retention (anti-muscarinic effect), and nervous system reactions such as paraesthesia, twitching, dystonia, dyskinesia, extrapyramidal motor disturbances, tremor, convulsions, dizziness, hallucinations and decreased consciousness.⁽¹⁾⁽⁴⁾⁽⁵⁾⁽⁹⁾

Refer to SPC (see manufacturers section below) for a full list of adverse reactions.⁽¹⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to its low pH. Precaution should be taken to avoid extravasation.⁽¹⁾⁽¹¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

Incompatible: Solutions of pH greater than 6.8.

SODIUM CONTENT (mmol):

0.1mmol sodium per 50mg in 1mL ampoule (Martindale).^(9a)

pH:

pH 3.3 to 3.7 (undiluted).⁽²⁾⁽⁴⁾⁽¹¹⁾

OTHER COMMENTS:

1. It is known that cyclizine injection will crystallise if diluted with sodium chloride 0.9%. However, an investigation to check the physical compatibility of cyclizine when diluted with 5-10mL of sodium chloride 0.9% revealed that there is unlikely to be any problems if used immediately (within 30 minutes). The prepared dilution should still be checked for any crystallisation before administration. See 'links' below
2. Store below 25°C. Protect from light.⁽¹⁾
3. A slight yellow tint may develop during storage at room temperature, but this colour change does not indicate a loss of potency.⁽⁴⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Valoid 50mg/mL cyclizine lactate, Amdipharma Ltd, last updated April 2010
 - b) Cyclizine lactate 50mg/mL injection, Martindale Pharma, last updated October 2009
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 02/11/2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 02/11/2011
4. Trissel "Handbook on injectable drugs" 15th Edition pg447-450
5. British National Formulary No. 62, September 2011, accessed via www.bnf.org
6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003
 - a) British National Formulary for Children 2010-11 - no relevant information
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
9.
 - a) Drug Company name: Martindale Pharma. Date contacted 19/10/2010
 - b) Drug Company name: Amdipharma plc. Date contacted: 03/11/2011

10. The syringe pump: continuous subcutaneous infusions in palliative care. 2nd Edition 2005. Dickman A, Schneider J and Varga J.
11. UCLH Injectable Medicines Administration Guide. 3rd Edition 2010
12. QA Department, Charing Cross Hospital - PR Cowin
13. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 2 (NHS Lothian local amendment)

Intravenous

Daptomycin

MEDICINE NAME:

Daptomycin

TRADE NAME(S):

Cubicin®

PRESENTATION OF MEDICINE:

Vials containing daptomycin 350mg powder for reconstitution.⁽¹⁾

Vials containing daptomycin 500mg powder for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION:

IV infusion: Infuse over 30 minutes.⁽¹⁾

IV injection: Administer slowly over a minimum of 2 minutes.⁽¹⁾

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹¹⁾ If a central venous access device is unavailable a risk benefit analysis should be made on individual patient basis.

INSTRUCTIONS FOR RECONSTITUTION:

IV infusion: Reconstitute 350mg vial with 7mL or a 500mg vial with 10mL of sodium chloride 0.9% to give a final concentration of 50mg per 1mL. Further dilution is required. See Instructions for Dilution section.⁽¹⁾

IV injection: Reconstitute 350mg vial with 7mL or a 500mg vial with 10mL of sodium chloride 0.9%⁽¹⁰⁾ to give a final concentration of 50mg per 1mL.⁽¹⁾

Inject the diluent slowly down the side of the vial. Rotate the vial to completely wet the powder and allow to stand for 10 minutes. Gently swirl the vial for a few minutes. Do not shake as this will cause foaming of the product. The solution is clear pale yellow to light brown.⁽¹⁾

See Cubicin Poster June 09

DISPLACEMENT VALUE:

Negligible.⁽¹⁰⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: Dilute the reconstituted solution with sodium chloride 0.9% (typical volume 50mL).⁽¹⁾

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Stable for 12 hours at room temperature.⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9%⁽³⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Anaphylaxis, hypersensitivity reactions, wheeze, tachycardia, fever, rigors, flushing, vertigo, syncope, metallic taste, infusion site reactions. Monitor blood pressure and blood sugar. Ensure a baseline clotting profile and CPK level are obtained before first administration.⁽¹⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to low pH. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Aztreonam, ceftazidime, ceftriaxone, dopamine, fluconazole, gentamicin, heparin, levofloxacin, lidocaine.⁽¹⁾

Incompatible: Glucose containing solutions.⁽¹⁾

SODIUM CONTENT (mmol):

Negligible (less than 0.05mmol/vial) ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Reconstituted with sodium chloride 0.9% (50mg/mL) = 364mOsmol/Kg.⁽¹⁰⁾

Further diluted with sodium chloride 0.9% to a concentration of 20mg/mL = 323mOsmol/Kg.⁽⁹⁾

Further diluted with sodium chloride 0.9% to a concentration of 5mg/mL = 304mOsmol/Kg.⁽⁹⁾

pH:

4 to 5.⁽¹⁰⁾

OTHER COMMENTS:

1. Store vial in a refrigerator at 2-8°C.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Cubicin®, 6 February 2006. Updated 21/01/2011
2. Martindale "The Complete Drug Reference" 34th Edition
3. American Hospital Formulary Service Drug Information 2007"
4. Trissel "Handbook on injectable drugs 14th Edition"
5. British National Formulary No 57
6. Royal College of Paediatrics and Child Health "Medicines for Children 2003"
 - a) British National Formulary for Children 2008
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Novartis. Date contacted: 23/11/2007
10. Drug company name: Novartis. Date contacted: May 2010
11. Royal College of Nursing Standards for Infusion Therapy 3rd Edition Jan 2010.

Intravenous

Dexamethasone

There are several preparations of intravenous dexamethasone available in different concentrations. Check carefully that the preparation administered provides the prescribed dose

MEDICINE NAME:

Dexamethasone

TRADE NAME(S):

Dexamethasone (hameln, Hospira, MSD)

PRESENTATION OF MEDICINE:

Hameln preparations

Ampoules containing dexamethasone 3.3mg in 1mL (as sodium phosphate)^(1e)

Ampoules containing dexamethasone 6.6mg in 2mL (as sodium phosphate)^(1e)

Hospira preparations

Ampoules containing dexamethasone 3.3mg in 1mL (as sodium phosphate)^(1a)

Vials containing dexamethasone 6.6mg in 2mL (as sodium phosphate)^(1b)

MSD preparations

Ampoules containing dexamethasone 4mg in 1mL (as sodium phosphate)^(1c)

Vials containing dexamethasone 8mg in 2mL (as sodium phosphate)^(1d)

METHOD OF ADMINISTRATION:

Please note: When dexamethasone is prescribed, it means dexamethasone base,⁽¹¹⁾ therefore:

4mg dexamethasone = 1.2mL of Hospira/Hameln preparations and 1mL of MSD preparations.

8mg dexamethasone = 2.4mL of Hospira/Hameln preparations and 2mL of MSD preparations.

IV injection: Give by slow IV injection over 3-5 minutes.^{(1a-e)(2)(4)}

IV infusion: Give over 15-20 minutes.^{(1a-e)(6a)}

Continuous IV infusion: Give over 24 hours.^{(1a-e)(6a)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Give undiluted or dilute in sodium chloride 0.9% or glucose 5% to a volume appropriate for the patient's fluid intake.^{(1a-e)(4)(5)(9)}

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

24 hours^(1c-e)

FLUSHING:

Flush with sodium chloride 0.9% ^{(1a-c)(4)}

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

•Rapid IV injection of large doses may cause cardiovascular collapse, so administer slowly.^(1a-e)

- Anaphylactic reactions.^(1a-e)
- Dyspepsia, oesophageal and peptic ulceration.^{(1a-e)(5)}
- Transient tingling and burning in the perineal area.⁽²⁾⁽⁵⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Dexamethasone infusion is compatible with the following infusions (it is assumed that the infusions mix close to the vascular access device): Aciclovir, allopurinol, amifostine, amikacin, amphotericin, amsacrine, anidulafungin, aztreonam, bivalirudin, cisatracurium, cisplatin, cladribine, cyclophosphamide, cytarabine, dexmedetomidine, docetaxel, doripenem, doxorubicin, etoposide, famotidine, fentanyl, filgrastim, fluconazole, fludarabine, foscarnet, gemcitabine, granisetron, heparin sodium, hydromorphone, levofloxacin, linezolid, lorazepam, melphalan HCl, meropenem, methotrexate, milrinone, morphine, ondansetron, oxaliplatin, paclitaxel, pemetrexed disodium, piperacillin sodium-tazobactam sodium, potassium chloride, propofol, remifentanyl, sargramostim, sodium bicarbonate, sufentanil citrate, tacrolimus, teniposide, theophylline, thiotepa, vinorelbine, zidovudine.⁽⁴⁾

Compound sodium lactate (Hartmann's), Ringer's solution for injection,^{(1c)(1d)(5)}

Incompatible: Ciprofloxacin, idarubicin, methotrexate, midazolam, topotecan.^{(1e)(4)}

SODIUM CONTENT (mmol):

Negligible⁽⁹⁾⁽¹⁰⁾

OSMOLARITY / OSMOLALITY:

No information available⁽⁹⁾⁽¹⁰⁾⁽¹²⁾

pH:

pH 7.5-8.5.⁽²⁾⁽⁴⁾⁽⁹⁾⁽¹⁰⁾

OTHER COMMENTS:

1. In practice, if dexamethasone 4mg is prescribed and the salt is not stated, dexamethasone 4mg in 1mL (MSD preparation) or 4mg in 1.2mL (Hospira or Hameln preparations) is prepared and administered.⁽¹¹⁾
2. Store below 25°C and protect from light. Do not freeze.^(1a-1e)
3. Oct 2012 - The SPC has been revised since this monograph was last updated (see link below).

REFERENCES:

1. Summary of Product Characteristics
 - a) Dexamethasone 3.3 mg/mL (1mL ampoules) Solution for Injection (Hospira UK Ltd), last revised Dec 2009.
 - b) Dexamethasone 3.3 mg/mL (2mL vials) Solution for Injection (Hospira UK Ltd), last revised April 2010.
 - c) Dexamethasone 4mg/mL Injection (MSD Ltd), last revised Jan 2011
 - d) Dexamethasone 8mg/mL Injection (MSD Laboratories Ltd), last revised Jan 2011
 - e) Dexamethasone 3.32mg/mL (1mL and 2mL ampoules) Solution for Injection (Hameln Pharmaceuticals Ltd), last revised April 2011
2. Martindale "The Complete Drug Reference" accessed via

- <http://www.medicinescomplete.com> in Sept 2012
3. American Hospital Formulary Source Drug Information accessed via <http://www.medicinescomplete.com> in Sept 2012
 4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> in Sept 2012
 5. British National Formulary edition 63, March 2012
 6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2012.
 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
 8. COSHH report compiled by manufacturer
a) Hospira UK Ltd
b) MSD Laboratories Ltd
 9. Drug company name: Hospira UK Ltd
Date contacted: 28/06/10
 10. Drug company name: MSD Laboratories Ltd
Date contacted: 18/01/12
 11. Personal communication from David Cousins Head of Safe Medication Practice, National Patient Safety Agency, 4-8 Maple Street, London W1T 5HD (19/06/09)
 12. Drug company name: hameln pharmaceuticals
Date contacted: 13/09/2012

Version 3

Intravenous

Diamorphine hydrochloride

High strength diamorphine (30mg, 100mg and 500mg) ampoules are reserved for patients already receiving diamorphine infusions and who require large daily doses. They are not suitable for the treatment of acute pain.

MEDICINE NAME:

Diamorphine hydrochloride

TRADE NAME(S):

Non-proprietary available from:
Teva UK
Auralis Ltd
Wockhardt UK Ltd

PRESENTATION OF MEDICINE:

Vials containing powder for reconstitution of diamorphine hydrochloride 5mg, 10mg, 30mg, 100mg and 500mg.^(1a-o)

METHOD OF ADMINISTRATION:

Slow IV injection:

Myocardial Infarction; at a maximum rate of 1-2mg/minute⁽⁵⁾

Acute Pulmonary Oedema; at a rate of 1mg/minute⁽⁵⁾

Use low strength diamorphine ampoules only, e.g. diamorphine 5mg, to reduce the risk of overdose.

N.B The patient may not require the contents of the whole ampoule selected for use.

Check the dose is appropriate for the patient before administration.

Continuous or short infusion: Give via an infusion pump

Ensure that naloxone injection, an antidote to opiate-induced respiratory depression, is available in all clinical locations where diamorphine and morphine injections are stored or administered.

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute with 1mL water for injections, glucose 5% or sodium chloride 0.9%.^(1a-e)

However, if necessary very small volumes (less than 0.1mL) can be used. The minimum volume for reconstitution is 1mL for up to 100mg and 2mL for 500mg.⁽⁴⁾

DISPLACEMENT VALUE:

Negligible

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Can be further diluted with glucose 5% (preferred) or sodium chloride 0.9%.^(1a-o)

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

24 hours^(1f-o)

FLUSHING:

Flush with glucose 5% or sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Respiratory depression, sedation, postural hypotension and palpitations. Other common adverse effects include: nausea, vomiting, sweating, dizziness and confusion^(1a-o)

Monitor blood pressure, heart and respiratory rate and have naloxone and resuscitation equipment available.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Flucloxacillin, furosemide, metoclopramide, midazolam.⁽⁴⁾

Incompatible: Alkalis and mineral acids.^(1a-e,k-o)

SODIUM CONTENT (mmol):

Nil⁽⁹⁾

OSMOLARITY / OSMOLALITY:

5mg per mL in glucose 5% = 303mOsmol/L.⁽¹⁰⁾

pH:

3.8 to 4.4⁽⁴⁾

OTHER COMMENTS:

1. Diamorphine infusion is more stable in glucose 5% than sodium chloride 0.9%.⁽¹⁾⁽⁴⁾
2. Containers should be inspected for crystallisation prior to use, particularly when drug admixtures are to be administered.
3. NPSA Rapid Response Report: Reducing Dosing Errors with Opioid Medicines - 4 July 2008 can be accessed via 'links' section below

REFERENCES:

1. Summary of Product Characteristics
 - a) Diamorphine 5mg in 2mL, Teva UK last revised 27/10/2010 accessed via www.tevauk.com
 - b) Diamorphine 10mg in 2mL, Teva UK last revised 27/10/2010
 - c) Diamorphine 30mg in 2mL, Teva UK last revised 03/12/2010
 - d) Diamorphine 100mg in 5mL, Teva UK last revised 03/12/2010
 - e) Diamorphine 500mg in 5mL, Teva UK last revised 01/12/2101
 - f) Diamorphine 5mg, Auralis Ltd last revised 15/02/2010
 - g) Diamorphine 10mg, Auralis Ltd last revised 15/02/2010
 - h) Diamorphine 30mg, Auralis Ltd last revised 15/02/2010
 - i) Diamorphine 100mg, Auralis Ltd last revised 03/07/09
 - j) Diamorphine 500mg, Auralis Ltd last revised 03/07/09
 - k) Diamorphine 500mg, Wockhardt UK Ltd last revised 27/04/2007
 - l) Diamorphine 100mg, Wockhardt UK Ltd last revised 31/08/2007
 - m) Diamorphine 30mg, Wockhardt UK Ltd last revised 31/08/2007
 - n) Diamorphine 10mg, Wockhardt UK Ltd last revised 31/08/2007
 - o) Diamorphine 5mg, Wockhardt UK Ltd last revised 31/08/2007
2. Martindale accessed via www.medicinescomplete.com on 01/06/2011

3. American Hospital Formulary Service Drug Information, accessed via www.medicinescomplete.com on 01/06/2011
4. Trissel "Handbook on Injectable Drugs" accessed via www.medicinescomplete.com on 11/04/2011
5. British National Formulary Edition no. 62 Sept 2011 accessed via www.bnf.org.uk
6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003.
 - a) British National Formulary for Children 2010-2011 accessed via www.bnfc.org.uk
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
9.
 - a) Drug Company name: Teva. Date contacted: July 11
 - b) Drug company name: Auralis. Date contacted: June 11
 - c) Drug company name: Wockhardt. Date contacted: July 11
10. Quality Control Department, Imperial College NHS Trust Feb11

Version 3

Intravenous

Diazepam emulsion

Caution: Do not confuse with diazepam solution

MEDICINE NAME:

Diazepam emulsion

TRADE NAME(S):

Diazemuls®

PRESENTATION OF MEDICINE:

Ampoules containing diazepam 10mg in 2mL as a sterile, milky white emulsion.⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: Give undiluted by slow IV injection at a maximum rate 1mL per minute (1mL = 5mg) into a large vein.⁽⁵⁾

Give over 3-5 minutes in children.^(6a)

Continuous infusion: Administer into a large vein⁽⁵⁾ using an infusion pump. Use a non-PVC infusion container and administration set⁽¹⁾ (see 'OTHER COMMENTS').

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Infusion: Use glucose 5% as diluent.⁽¹⁾ There is a risk of precipitation occurring so care is needed when diluting.⁽²⁾

Add between 2 and 8mL per 100mL glucose 5% to give a concentration of 100-400micrograms in 1mL (0.1-0.4mg in 1mL).⁽¹⁾

Do not exceed a maximum concentration 200mg (40mL) in 500mL.⁽⁵⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

Use infusion within 6 hours⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Respiratory depression and hypotension occasionally occur.⁽²⁾ Monitor cardio-respiratory function.⁽²⁾
2. Urticaria and rarely anaphylaxis have been reported following diazepam injection.⁽¹⁾
3. Diazepam may rarely cause local pain and thrombophlebitis.⁽¹⁾ Diazepam emulsion is associated with a lower incidence of local reactions compared to diazepam solution.⁽²⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusions (it is assumed that medicines meet close to the vascular access device): May be administered via an on-going infusion of sodium chloride 0.9%, glucose 5%, glucose 10% or Intralipid 10% or 20%.⁽¹⁾

Incompatible: Do not infuse with any other medicines other than the recommended infusion fluids.⁽¹⁾

SODIUM CONTENT (mmol):

Negligible (0.096mg sodium in 2mL) ⁽⁹⁾

pH:

5 to 9 ⁽⁹⁾

OTHER COMMENTS:

1. Avoid using PVC infusion bags. Glass bottles, non PVC sets or syringe pumps using a non-PVC syringe are suitable for use.⁽⁴⁾ If PVC tubing is used it should be the shortest possible length with a small diameter and the set should not contain a burette chamber.⁽⁴⁾
2. Contains soya bean oil and fractionated egg phospholipid; contraindicated to patients with soya bean or egg allergy.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics. Diazepam emulsion (Diazemuls®), last updated 10/06/2011
2. Martindale "The Complete Drug Reference" on line, accessed via www.medicinescomplete.com 02/12/2012
3. American Hospital Formulary Service Drug Information online, accessed via www.medicinescomplete.com 02/12/2012
4. Trissel "Handbook on Injectable Drugs" 14th Edition, 2007, pg 508
5. British National Formulary No. 64, September 2012, pg 987
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2012-2013 pg 236
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSH report compiled by the manufacturer
9. Drug company name: Actavis; Date contacted: 06/12/2012

Version 6

Intravenous

Diazepam solution

Caution: Do not confuse with Diazemuls® - diazepam emulsion

MEDICINE NAME:

Diazepam

TRADE NAME(S):

Diazepam injection BP (Wockhardt UK Ltd) (hameln)

PRESENTATION OF MEDICINE:

Ampoules containing 10mg in 2mL^(1a-b)

Ampoules 20mL in 4mL.^(1b)

Clear, colourless to pale yellow liquid.

METHOD OF ADMINISTRATION:

IV injection: give by slow IV injection at a maximum rate 1mL per minute (1mL = 5mg) into a large vein of the antecubital fossa.^(1a) Give over 3 to 5 minutes in children.^(6a)

Continuous infusion: Administer via a large vein⁽⁵⁾ using an infusion pump. Use a non-PVC infusion container and administration set.⁽¹⁾ (see 'OTHER COMMENTS').

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: Dilute with sodium chloride 0.9%⁽⁵⁾ or glucose 5%.⁽⁵⁾ there is a risk of precipitation; care on dilution.⁽²⁾

Not more than 10mg (2mL) diazepam should be added to each 200mL of infusion solution.⁽⁵⁾

Not more than 40mg (8mL) diazepam should be added to each 500mL of infusion solution.^(1b)

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

6 hours^(1b)

FLUSHING:

Sodium chloride 0.9% or glucose 5%^{(1a)(10)}

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Administration may be associated with local reactions (thrombophlebitis and venous thrombosis). To reduce these effects give into a large vein of the antecubital fossa.⁽¹⁾ Diazepam emulsion (Diazemuls®) is associated with lower incidence of local reaction than diazepam solution.⁽²⁾
2. Can cause respiratory depression or apnoea and hypotension occasionally occurs.^(1b) Monitor cardio respiratory function.⁽²⁾
3. Patients should remain supine and under medical supervision for 1 hour post injection.^(1a) Have resuscitation equipment available.^(1a)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines.^(1a)

Compatible infusion fluids: Sodium chloride 0.9%, glucose 5%.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

None ^(1a)

SODIUM CONTENT (mmol):

Negligible. ^{(1a)(9)}

OSMOLARITY / OSMOLALITY:

No information ⁽⁹⁾

pH:

6.2 to 7.0 ⁽¹⁰⁾

OTHER COMMENTS:

1. Substantial adsorption of up to 50% diazepam onto some plastics may cause problems when administering the drug by continuous infusion. Administration sets and bags containing polyvinylchloride (PVC) in particular should be avoided. ⁽²⁾⁽⁴⁾ Suitable materials for infusion and administration sets include glass, polyolefin, polypropylene, polyethylene. ⁽²⁾ Syringe pumps can be used since adsorption to plastic syringes made from polypropylene and polyethylene, has not been found. ⁽⁴⁾
2. Excipients:
Benzyl alcohol (Wockhardt product only) - There is a risk of alcohol poisoning with prolonged use of high-dose intravenous infusions of diazepam injection containing benzyl alcohol. ^(1a) Avoid use in neonates. ^{(1a)(5)} Benzyl alcohol may cause toxic reactions and anaphylactoid reactions in infants and children up to three years old. ^(1a)
Benzoic acid and sodium benzoate (Wockhardt product only) - may increase the risk of jaundice in newborn babies. ^(1a)
Ethanol - A small amount of ethanol, less than 100mg per ampoule.
Propylene glycol - Impaired elimination of propylene glycol eg in renal failure, neonates, young children and in slow metabolisers can cause adverse effects, ⁽⁵⁾ most commonly central nervous system depression. ⁽²⁾
There have been rare reports of propylene glycol toxicity (e.g. increased anion gap, metabolic acidosis, hyperosmolality, renal impairment) with the potential for organ system failure and circulatory shock, in patients treated with continuous infusions of diazepam. Central nervous system toxicity, including seizures, as well as unresponsiveness, tachypnoea, tachycardia and diaphoresis have also been associated with propylene glycol toxicity. Symptoms may be more likely to develop in patients with renal or hepatic impairment and in paediatric patients. ^(1b)

REFERENCES:

1. Summary of Product Characteristics
 - a) Wockhardt last revised 16/09/2008
 - b) hameln, last revised 03/10/2012
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com December 2012
3. American Hospital Formulary Service Drug Information online, accessed via www.medicinescomplete.com December 2012

4. Trissel "Handbook on Injectable Drugs" accessed via www.medicinescomplete.com December 2011
5. British National Formulary Edition No. 64, pg 987
6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003
a) British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
9. Drug company name: hameln Pharmaceuticals Ltd; Date contacted: 06/12/2012
10. Drug company name: Wockhardt UK Ltd; Date contacted: 06/12/2012

Version 5

Intravenous

Diclofenac sodium

Dyloject® injection is different to this injection and has its own monograph. Please check carefully that the correct monograph corresponds to the correct product.

MEDICINE NAME:

Diclofenac sodium

TRADE NAME(S):

Voltarol®, Novartis Pharmaceuticals UK Ltd
Diclofenac, Goldsheild

PRESENTATION OF MEDICINE:

Ampoules containing diclofenac 75mg in 3mL (as sodium salt).^{(1a)(1b)}

METHOD OF ADMINISTRATION:

Diclofenac injection must NOT be given as an intravenous bolus injection.
Do not exceed 150mg in 24 hours.^{(1a)(1b)}

IV Infusion:

1. Slow IV infusion for the treatment of post-operative pain:- Administer 75mg over 30 minutes to 2 hours. Repeat after 4 to 6 hours if necessary.^{(1a)(1b)(2)(5)}
2. Continuous infusion for the prevention of post-operative pain:- administer a loading dose of 25-50mg after surgery over 15 to 60minutes followed by a continuous infusion of approximately 5mg/hour.^{(1a)(1b)(2)(5)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Prior to infusion, dilute the required dose with 100-500mL sodium chloride 0.9% or glucose 5%. The solution should be buffered with sodium bicarbonate solution (0.5mL of 8.4% or 1mL of 4.2%).^{(1a)(1b)} Only clear solutions should be used.^{(1a)(1b)(5)}

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Infusions should be freshly made up and used immediately.^{(1a)(1b)}

FLUSHING:

Sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypersensitivity reactions; varying from rash and urticaria to bronchospasm and anaphylaxis. Diclofenac injection should be discontinued at the first appearance of skin rash, mucosal lesions, or any other sign of hypersensitivity.^{(1a)(1b)(5)}

Gastrointestinal disorders: epigastric pain, dyspepsia, nausea, vomiting, diarrhoea, gastrointestinal bleeding.^{(1a)(1b)(5)}

Headache, malaise, dizziness or vertigo.^{(1a)(1b)(5)}

Hypertension,^{(1a)(1b)(5)} monitor blood pressure.

EXTRAVASATION:

No information available.⁽⁹⁾⁽¹¹⁾ However, if extravasation occurs, diclofenac injection has the potential to cause tissue injury because it contains propylene glycol.^{(1a)(1b)} If extravasation occurs refer to local treatment policies.⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not mix with any other medicines or infusion fluids, except for named diluents ^{(1a)(1b)}

SPECIAL HANDLING PRECAUTIONS:

No additional information ⁽⁸⁾

SODIUM CONTENT (mmol):

Negligible, approximately 0.3mmol per 3mL (Voltarol®) ampoule ⁽⁹⁾ or 0.09mmol per 3mL ampoule. ⁽¹¹⁾

OSMOLARITY / OSMOLALITY:

Osmolarity.

297-402mOsmol ⁽¹²⁾.

pH:

pH 7.8 to 9 ⁽⁹⁾, 7.6 to 8.6 ⁽¹¹⁾

OTHER COMMENTS:

1. Diclofenac injection (given IV or IM) should not be administered for more than 2 days, treatment can be continued with diclofenac tablets or suppositories. ^{(1a)(1b)(2)}
2. Protect ampoules from light and heat. ^(1a) Store below 30°C, ^(1a) (not above 25°C. ^(1b)
3. Diclofenac injection is not recommended for use in children. ^{(1a)(1b)}
4. Undesirable effects may be minimised by using the lowest effective dose for the shortest duration necessary to control symptoms. ^{(1a)(1b)}

REFERENCES:

1. Summary of Product Characteristics
 - a) Voltarol® 75mg/3mL (Novartis). Date of revision of text March 2009
 - b) Diclofenac Injection BP 75mg/3mL (Goldshield). Last revised March 2009
2. Martindale accessed via <http://www.medicinescomplete.com> May 2010
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> May 2010
4. Trissel "Handbook on injectable drugs" 15th Edition accessed via <http://www.medicinescomplete.com> May 2010
5. British National Formulary No. 59, March 2010
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer, Novartis Pharmaceuticals.
9. Drug company name: Novartis Pharmaceuticals
Date contacted: 30/06/10
10. www.extravasation.org.uk
11. Drug company name: Goldshield Pharmaceuticals Ltd.
Date contacted: May 2010

12. Quality Assurance department, Charing Cross Hospital. July 2010.
13. Guy's and St Thomas' Injectable Medicines Guide, accessed via <http://medusa.wales.nhs.uk>, revised May 2007

Version 3

Intravenous

Digoxin immune Fab (DigiFab)

MEDICINE NAME:

Digoxin immune Fab (ovine)

TRADE NAME(S):

DigiFab®

PRESENTATION OF MEDICINE:

Each vial of DigiFab® contains 40mg of digoxin immune Fab (ovine) protein as a sterile, lyophilized, off white powder.⁽¹⁾

METHOD OF ADMINISTRATION (adult):

IV infusion: Administer as an IV infusion over 30 minutes using an infusion pump.

The manufacturer of DigiFab® states that inline membrane IV filters were not used during clinical trials with this preparation and does not recommend their use for administration of the drug.⁽³⁾

IV injection: If cardiac arrest is imminent, digoxin immune Fab may be administered by IV injection over 3-5 minutes, but this method of administration generally is not recommended for other patients since it may be associated with increased risk of adverse effects (e.g. allergic reactions).⁽³⁾

For infants or small children receiving small doses, the dose may be given by IV injection using a tuberculin syringe. Alternatively the required dose may be further diluted to any convenient volume with sodium chloride 0.9% and administered by IV injection or infusion.⁽³⁾

INSTRUCTIONS FOR RECONSTITUTION (adult):

Reconstitute the contents of each vial with 4mL of water for injections by gentle mixing to produce a protein concentration of 10mg/mL.⁽¹⁾

The reconstituted solution should be a clear to slightly opalescent, colourless to pale-yellow solution.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

The reconstituted solution can be diluted further to any convenient volume with sodium chloride 0.9%.⁽¹⁾

When very small doses (3mg or less) are required, the reconstituted 4mL solution of DigiFab® may be diluted with 36mL of sodium chloride 0.9% to provide a solution containing 1mg/mL.⁽³⁾

EXAMPLE CALCULATION (adult):

Management follows a step-wise decision process as follows:⁽¹⁾

Step 1. Decide if digoxin poisoning is (i) Acute (ii) Acute-on-chronic (iii) Chronic

Step 2. Is the patient (i) an adult or child greater than 20kg or (ii) a child less than 20kg?

Step 3. Is (i) the amount of digoxin ingested known or is (ii) the serum concentration of digoxin known?

Step 1 (i) Acute digoxin poisoning

Half the estimated dose required for full neutralisation can be given initially followed by monitoring for 6-12 hours if there is a full response. The remainder may be given if there is no clinical response within 2 hours.

Step 1 (ii) Acute-on-chronic digoxin poisoning

A full neutralisation dose of DigiFab® can be given if the amount of digoxin ingested is known. If the amount of digoxin ingested is not known then a half-neutralising dose of DigiFab® based on serum digoxin concentration should be used followed by monitoring for 6-12 hours if there is a full response. The remainder may be given if there is no clinical response within 2 hours.

The usual dose for adults and children over 20kg may vary between one half of a vial (20mg DigiFab®) to 20 vials (800mg DigiFab®). More vials may be needed dependent upon the amount of digoxin consumed.

Step 1 (iii) Chronic digoxin poisoning

Half the estimated dose required for full neutralisation can be given initially followed by monitoring for 6-12 hours. The remainder may be given if there is recurrence of toxicity.

The dose for DigiFab® for full neutralisation following digoxin poisoning can be calculated as follows:⁽¹⁾

Step 2 (i) Adults and children : greater than 20kg

Step 3 (i) Dose of ingested digoxin known:

Full neutralisation dose of DigiFab® is: Dose (number of vials) = amount of digoxin ingested (mg) x 1.6

Round up to the nearest vial.

To calculate the number of milligrams to be prescribed multiply the number of vials by 40 (as there are 40mg/vial).

Step 3 (ii) Serum digoxin concentration known:

Full neutralisation dose of DigiFab® is:

$$\text{Dose (in number of vials)} = \frac{\text{serum digoxin concentration (nanograms/mL)} \times \text{patient weight (kg)}}{100}$$

Round up to the nearest vial.

To calculate the number of milligrams to be prescribed multiply the number of vials by 40 (as there are 40mg/vial).

Dose of ingested digoxin unknown and serum digoxin concentration unknown:⁽⁹⁾

For adults or children over 20kg presenting with life-threatening digoxin toxicity caused by an acute ingestion where neither a serum digoxin concentration nor an estimation of ingested amount is available, 20 vials of DigiFab® may be administered. However in small children it is important to monitor for volume overload. In general, a larger dose of DigiFab® has a faster onset of effect but may enhance the possibility of a febrile reaction. In such cases, 10 vials may be administered first with careful monitoring of the patient's response followed at the physicians discretion by 10 additional vials and continued monitoring.

For adults or children over 20kg who present with toxicity during chronic digoxin therapy for whom a serum digoxin concentration is not available, 6 vials of DigiFab® should be adequate to reverse most cases of toxicity.

Step 2 (ii) Children : less than 20kg

Step 3 (i) Serum digoxin concentrations not known

One vial of DigiFab® will usually be sufficient for full neutralisation.

Step 3 (ii) Serum digoxin concentration known:

Full neutralisation dose of DigiFab® is:

$$\text{Dose (in number of vials)} = \frac{\text{serum digoxin concentration (nanograms/mL)} \times \text{patient weight (kg)}}{100}$$

Round up to the nearest vial.

To calculate the number of milligrams to be prescribed multiply the number of vials by 40 (as there are 40mg/vial).

Converting units of digoxin nanograms/mL to/from nanomol/L

nanograms/mL (or micrograms/L) x 1.28 = nanomol/L

nanomol/L x 0.781 = nanograms/mL (or micrograms/L)

FLUSHING:

Flush with sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Infusion-related reactions or hypersensitivity reactions are possible. It is recommended that patients are monitored for signs and symptoms of anaphylaxis and acute allergic reaction. The likelihood of an allergic reaction is higher in subjects that are allergic to sheep-derived protein (as may be found in cheeses and meats) and papain (an extract of the papaya fruit which is used to cleave the whole antibody into Fab and Fc fragments).⁽¹⁾

Serum potassium levels should be monitored due to the possibility of hypokalemia, especially during the first few hours following administration of Fab fragments.⁽³⁾

Adverse reactions may occur up to 14 days after the infusion has been administered and may include hypokalemia, hyperkalemia, headache, confusional state, nausea, vomiting, diarrhoea, constipation, abdominal distention, worsening of cardiac failure, chest pain, hypotension, orthostatic hypotension, influenza-like illness, renal failure, fatigue and infusion-site phlebitis.⁽¹⁾

EXTRAVASATION:

No information available.⁽⁹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

The manufacturer does not recommend mixing with other medicinal products as there are no compatibility studies done.⁽¹⁾⁽⁹⁾

SODIUM CONTENT (mmol):

Negligible. Each 40mg vial contains 2mg of sodium acetate.⁽³⁾

pH:

4.5 to 5.5.⁽³⁾

OTHER COMMENTS:

1. The vials should be stored between 2 and 8°C. Do not freeze. The vials should be kept in the outer carton in order to protect from light.⁽¹⁾
2. DigiFab® contains sodium acetate as a buffering agent, acetic acid and mannitol as a stabilizer.⁽¹⁾⁽³⁾
3. It is estimated that 40mg of antibody fragments can bind about 500micrograms of digoxin or digitoxin.⁽²⁾
4. If after several hours toxicity has not adequately reversed or appears to recur, re-administration of DigiFab® at a dose guided by clinical judgment may be required. Failure of a patient to respond to DigiFab® should alert the physician to the possibility that the clinical problem may not be due to digoxin toxicity.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Digoxin Immune Fab (DigiFab), last revised 01/07/2011
2. Martindale accessed via <http://www.medicinescomplete.com/> on 30/09/2013
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com/> September 2013
4. Trissel "Handbook on injectable drugs" 16th Edition
5. British National Formulary accessed via <http://www.medicinescomplete.com> on 30/09/2013
6. British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by manufacturer
9. Drug Company name: BTG International Ltd. Date contacted: 27/03/2012

Version 3 (NHS Lothian local amendment)

Intravenous

Digoxin

MEDICINE NAME:

Digoxin

TRADE NAME(S):

Lanoxin[®]

Generic (Antigen International Ltd)

PRESENTATION OF MEDICINE:

Ampoules containing 500micrograms in 2mL (ampoules) ⁽⁵⁾

METHOD OF ADMINISTRATION:

Normal practice is to give as an infusion over 1-2 hours in 50 to 100mL of diluent for both maintenance and loading doses.

Minimum time: 10 - 20 minutes. ⁽¹²⁾

N.B. when administering as an emergency loading dose the BNF recommends an infusion duration of at least 120 minutes (unlicensed). ⁽⁵⁾

Note that the manufacturer recommends reducing doses by approximately a third when converting from oral to IV therapy. ^(1a)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: Dilute 1 part digoxin with at least 4 parts of suitable diluent. Volume used for adults is usually 50-100mL (maximum 500mL). ⁽¹¹⁾⁽¹²⁾

Suitable diluents are sodium chloride 0.9% ^{(1a)(1b)(4)} or glucose 5%. ^{(1a)(1b)(4)}

N.B. The use of less than a 4-fold dilution could lead to precipitation of digoxin. ^(1a)

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Use immediately

FLUSHING:

Flush with sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Rapid intravenous injection can cause vasoconstriction producing hypertension and/or reduced coronary flow. ^{(1a)(1b)(2)}

Monitor heart rate, blood pressure and ECG.

In case of suspected toxicity an antidote is available: Digibind[®] ^(1a)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device): ⁽⁴⁾

Ciprofloxacin in both glucose 5% and sodium chloride 0.9%

Cisatracurium besylate in glucose 5%

Insulin, regular (Humulin R) in sodium chloride 0.9%

Linezolid

Meropenem in sodium chloride 0.9%

Midazolam hydrochloride in glucose 5%

Milrinone lactate in glucose 5%

Morphine sulphate
Potassium chloride
Remifentanyl hydrochloride in sodium chloride 0.9%

Incompatible: ⁽⁴⁾

Amiodarone in glucose 5%
Amphotericin B cholesteryl sulfate complex (Amphocil®) in glucose 5%
Fluconazole
Insulin, regular (Humulin R) in glucose 5%
Propofol

SPECIAL HANDLING PRECAUTIONS:

No special control measures required for the normal handling of this product ^(8a)

SODIUM CONTENT (mmol):

Lanoxin brand - 25.2mmol/L ^(9a)

OSMOLARITY / OSMOLALITY:

No information available ^(9a)

pH:

6.8 to 7.2 ^{(9a)(9b)}

OTHER COMMENTS:

1. Monitor renal function and serum levels of digoxin in patients on long-term therapy especially if toxicity suspected or dose adjustment is considered.
2. Check BNF for interactions with other medicines.
3. The intramuscular route is painful and associated with muscle necrosis. This route cannot be recommended. ^(1a)

REFERENCES:

1. Summary of Product Characteristics.
 - a) Lanoxin injection. Last updated 08 March 2010. Accessed via <http://emc.medicines.org.uk> on 23/04/2010
 - b) Digoxin injection BP 500micrograms in 2mL. Last updated 13/07/2009 accessed via <http://emc.medicines.org.uk> on 10/02/2010
2. Martindale "The Complete Drug Reference" 35th Edition. Digoxin monograph accessed via www.medicinescomplete.com/mc/ on 23/01/2009
3. American Hospital Formulary Service Drug Information. Digoxin monograph accessed via www.medicinescomplete.com/mc/ on 23/01/2009
4. Trissel "Handbook on injectable drugs" 15th Edition. Digoxin monograph accessed via www.medicinescomplete.com/mc/ on 23/01/2009
5. British National Formulary No. 57 March 2009 accessed via www.bnf.org/bnf on 25/03/2009
6. Medicines for Children produced by the Royal College of Paediatrics and Child Health 2003

- a) British National Formulary for Children 2008 accessed via www.bnfc.org/bnfc on 25/03/2009
- 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
- 8. a) COSHH data sheet. GlaxoSmithKline. Date of preparation 01/08/2006
b) COSHH data sheet. Goldshield Pharmaceuticals. Date of preparation 17/04/2007
- 9. a) Manufacturer name: GlaxoSmithKline, Date contacted: 31/03/2009
b) Manufacturer name: Goldshield Pharmaceuticals, Date contacted: 31/03/2009
- 10. Examples of Risk Assessments of injectable medicine products prepared in clinical areas.
<http://medusa.wales.nhs.uk/Docs/InjectableMedicinesRiskAssessmentexamplesNHS.doc>
- 11. Hammersmith Hospitals NHS Trust. Intravenous Medicine Administration (section six of the Medicines & Blood Transfusion Policies). Last revised November 2004
- 12. Injectable Medicines Administration Guide, 2nd Edition, Pharmacy Department, University College London Hospitals NHS Foundation Trust.

Version 4 (NHS Lothian local amendment)

Intravenous

Disodium pamidronate (dry powder)

Some information in this monograph is brand specific. Ensure you refer to the correct information for the brand used in your Trust

MEDICINE NAME:

Disodium pamidronate

TRADE NAME(S):

Aredia Dry Powder® (Novartis)

PRESENTATION OF MEDICINE:

Vial containing disodium pamidronate 15mg dry powder. Plus 5mL ampoule containing sterile water for injections for reconstitution.⁽¹⁾

Vial containing disodium pamidronate 30mg dry powder. Plus 10mL ampoule containing sterile water for injections for reconstitution.⁽¹⁾

Vial containing disodium pamidronate 90mg dry powder. Plus 10mL ampoule containing sterile water for injections for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION:

IV infusion: via an infusion pump at a rate not exceeding 60mg/hour (1mg/minute) and not exceeding a rate of 20mg/hour in renal impairment.⁽¹⁾

Do not administer by IV bolus injection.⁽¹⁾⁽²⁾

In order to minimise local reactions at the infusion site, the cannula should be inserted carefully into a relatively large vein.⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Dissolve powder in sterile water for injections provided with each vial. Using aseptic technique add 5mL water for injections to each 15mg vial; 10mL water for injections to each 30mg vial and each 90mg vial. The powder should be completely dissolved prior to dilution.⁽¹⁾

DISPLACEMENT VALUE:

15mg vial - no information available ⁽⁹⁾

30mg vial - 0.34mL ⁽⁹⁾

90mg vial - 0.31mL ⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

The reconstituted solution should be further diluted with a calcium free infusion solution, sodium chloride 0.9% or glucose 5% intravenous infusion recommended. The concentration should not exceed 60mg in 250mL.⁽¹⁾⁽²⁾

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

After preparation in the clinical area the infusion should be used immediately.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5% ⁽¹⁾⁽⁹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Usually mild and transient. Hyper- or hypotension; monitor blood pressure. Fever and flu-like symptoms. Occasionally injection site reactions such as pain, redness, swelling, induration, phlebitis and thrombophlebitis.⁽²⁾⁽³⁾⁽⁵⁾

Monitor serum electrolytes; calcium, phosphates, magnesium as hypophosphataemia, hypocalcaemia and hypomagnesaemia can occur.⁽¹⁾⁽²⁾

EXTRAVASATION:

Disodium pamidronate has not been shown to have an extreme pH, a high osmolarity and is not a cytotoxic medicine and is therefore unlikely to cause tissue damage if extravasation occurs.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):
No information

Incompatible: Incompatible with calcium containing intravenous solutions eg. Ringer's solution.⁽¹⁾

SODIUM CONTENT (mmol):

No information available.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

15mg, 30mg and 90mg vials when reconstituted with water for injections as directed has an osmolarity of 287mOsm/kg⁽⁹⁾

pH:

pH of solution when reconstituted with water for injections is 6.0 to 7.4⁽⁹⁾

OTHER COMMENTS:

1. Reconstituted solution that has been further diluted must be used immediately.⁽¹⁾
2. December 2011 - The SPC has been revised since this monograph was last updated

REFERENCES:

1. Summary of Product Characteristics, Aredia®, last updated February 2008
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 18/11/2009
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 18/11/2009
4. Trissel "Handbook on injectable drugs"
5. British National Formulary No. 58, September 2009 pgs 423, 424, 872
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)

8. COSHH report compiled by manufacturer
9. a) Drug company name: Novartis Pharmaceuticals Ltd
Date contacted: 09/10/2009 and 19/01/2010
10. <http://www.palliativedrugs.com/bisphosphonates.html> accessed 30 October 2009

Version 4

Intravenous

Disodium pamidronate (concentrate for dilution)

Some information in this monograph is brand specific. Ensure you refer to the correct information for the brand used in your Trust

MEDICINE NAME:

Disodium pamidronate

TRADE NAME(S):

Disodium pamidronate sterile concentrate (Hospira UK Ltd)
Disodium pamidronate sterile concentrate (Wockhardt UK Ltd)
Disodium pamidronate sterile concentrate (Medac UK)

PRESENTATION OF MEDICINE:

Vials containing disodium pamidronate 15mg in 5mL. Concentrate for dilution.^(1a-d)
Vials containing disodium pamidronate 30mg in 10mL. Concentrate for dilution.^(1a-d)
Vials containing disodium pamidronate 60mg in 10mL. Concentrate for dilution.^(1a-c)
Vials containing disodium pamidronate 90mg in 10mL. Concentrate for dilution.^(1a-c)
Vials containing disodium pamidronate 60mg in 20mL. Concentrate for dilution.^(1a-d)
Vials containing disodium pamidronate 90mg in 30mL. Concentrate for dilution.^(1a-d)

Ampoules containing disodium pamidronate 15mg in 1mL. Concentrate for dilution.^(1e)
Ampoules containing disodium pamidronate 30mg in 2mL. Concentrate for dilution.^(1e)
Ampoules containing disodium pamidronate 60mg in 4mL. Concentrate for dilution.^(1e)
Ampoules containing disodium pamidronate 90mg in 6mL. Concentrate for dilution.^(1e)

METHOD OF ADMINISTRATION:

IV infusion: Administer at a maximum rate of not more than 60mg/hour (1mg/minute). In patients with renal failure administer at a rate of not more than 20mg/hour.^{(1a-e)(2)}

Medac:

Medac specify that a dose of 90mg must usually be administered as a 2 hour infusion.^(1d)
Medac recommend that for multiple myeloma and tumour induced hypercalcaemia, the infusion rate does not exceed 90mg in 500mL over 4 hours.^(1d)
Medac specify that disodium pamidronate should not be administered if creatinine clearance is less than 30mL/min.^(1d)

Should not be administered by IV bolus injection.^{(1d)(1e)}

In order to minimise local reactions at the infusion site, the cannula should be inserted carefully into a relatively large vein.^(1a-e)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Disodium pamidronate sterile concentrate injection must be diluted prior to administration in sodium chloride 0.9% or glucose 5% infusion solutions.^(1a-e) The concentration should not exceed 60mg in 250mL.^{(1a-e)(2)(5)}

Medac:

Medac specify that concentration should not exceed 90mg in 250 mL.^(1d)

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Chemically and physically stable for 24 hours at room temperature (25°C), but use immediately from a microbiological view.^(1a-e)

FLUSHING:

Flush with either sodium chloride 0.9% or glucose 5% ^{(9b)(9c)}

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Usually mild and transient. Fever and flu-like symptoms usually resolve spontaneously. Hyper- or hypotension; monitor blood pressure. Occasionally local reactions at infusion site such as pain, inflammation, redness, swelling, induration, phlebitis and thrombophlebitis. ^{(1d)(1e)}

Monitor serum calcium, phosphate and magnesium. ^{(1a-e)(5)}

EXTRAVASATION:

Disodium pamidronate has not been shown to have an extreme pH, a high osmolarity and is not a cytotoxic medicine and is therefore unlikely to cause tissue damage if extravasation occurs.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Where possible disodium pamidronate infusion should not be mixed with any other IV solution.

Compatible: No information ^{(4)(9a-c)}

Incompatible: Incompatible with calcium containing intravenous solutions ^(1a-e) e.g. compound sodium lactate, Ringer's solution.

Incompatible with lipophilic nutrition solution e.g. soya-bean oil. ^(1d)

SPECIAL HANDLING PRECAUTIONS:

No information ^(9a-c)

SODIUM CONTENT (mmol):

Hospira: Amounts are negligible for each vial

0.108mmol per 15mg vial

0.215mmol per 30mg vial

0.43mmol per 60mg vial

0.645mmol per 90mg vial ^(9a)

Medac:

0.11mmol sodium per 15mg vial

0.22mmol sodium per 30mg vial

0.43mmol sodium per 60mg vial

0.65mmol sodium per 90mg vial ^(9b)

Wockhardt: 1.04mmol per 90mg ampoule ^(9c)

OSMOLARITY / OSMOLALITY:

No information available. ^{(9a)(9b)(9c)}

pH:

Hospira: pH of original concentrate 6.0-7.0 ^(9a)

Medac: pH of original concentrate 7.0-8.0 ^(9b)

Wockhardt: pH of original concentrate 7.5-8.5 ^(9c)

OTHER COMMENTS:

1. For the management of tumour-induced hypercalcaemia it is recommended that patients be rehydrated with 0.9% w/v sodium chloride solution before or during treatment. ^(1a-e)
2. Pamidronate solution that has been further diluted must be used immediately. ^(1a-e)

REFERENCES:

1. Summary of Product Characteristics
 - a) Hospira. Pamidronate disodium 3mg/mL, date of revised text 16/12/2008
 - b) Hospira. Pamidronate disodium 6mg/mL, date of revised text 16/12/2008
 - c) Hospira. Pamidronate disodium 9mg/mL, date of revision of text 16/12/2008
 - d) Medac GmbH. Disodium pamidronate, date of revised text 22/01/2009
 - e) Wockhardt. Disodium pamidronate, date of revised text January 2009
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 16/10/2009
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 16/10/2009
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> 01/11/2009
5. British National Formulary No. 58 September 2009 pg 423/4
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9.
 - a) Drug company name: Hospira UK Ltd
Date contacted: 29/10/2009 and 14/01/2010
 - b) Drug company name: Medac GmbH
Date contacted: 29/10/2009 and 15/01/2010
 - c) Drug company name: Wockhardt UK Ltd
Date contacted: 28/10/2009 and 15/01/2010
10. <http://www.palliativedrugs.com/bisphosphonates.html> Accessed 30/10/2009

Version 2

Intravenous

Dobutamine

MEDICINE NAME:

Dobutamine

TRADE NAME(S):

Non-proprietary available from Hameln
Goldshield (Braun)

PRESENTATION OF MEDICINE:

Ready to use infusion: Vial 250mg in 50mL (5mg in 1mL) ^(1a)

Preparations which require dilution before use: Ampoule 250mg in 20mL (12.5mg in 1mL) ^(1b,c)

METHOD OF ADMINISTRATION:

Continuous IV infusion: via an infusion pump. ^{(1a-c)(3)(4)}

Due to the low pH of this drug administer via a central venous access device. ⁽¹¹⁾

If central administration is not possible, solutions of a concentration of less than 5mg in 1mL may initially given via a large peripheral vein, but should be transferred to a central venous access device as soon as possible to reduce the risk of phlebitis.

Do not allow the infusion to run out. A new infusion should be prepared at least half an hour before the previous one finishes.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Adults: Preferably use the 250mg in 50mL preparation which does not require further dilution. ⁽¹²⁾ If this preparation is unavailable dilute the 250mg in 20mL preparation to 50mL with glucose 5% or sodium chloride 0.9%. ^{(1b-c)(12)}

Concentrations of 10mg in 1mL (500mg in 50mL) administered via a central venous access device have been used. ⁽¹⁰⁾

Solutions of dobutamine have a low pH and central administration is recommended. In exceptional circumstances where a central venous access device is not available and the infusion is going to be run for more than a couple of hours, use a solution of 1mg in 1mL and administer via a large peripheral vein.

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

24 hours at room temperature. ⁽¹⁾ Solutions may have a pink discolouration which will increase with time, resulting from a slight oxidation of the drug. There is no significant loss of drug potency within the recommended storage time for solutions of the drug. ^{(1a,c)(4)}

EXAMPLE CALCULATION:

Infusion rate: The infusion rate can be calculated from the following equation:

$$\text{Dobutamine infusion rate (mL/hour)} = \frac{\text{Dose (micrograms /kg/minute)} \times \text{patient weight (kg)} \times 60 \text{ (minutes)}}{1,000 \times \text{concentration (mg/mL)}}$$

For example: To administer a dose of 2.5 micrograms/kg/minute of dobutamine to a 70kg patient using a standard solution of 250mg in 50mL (5mg in 1mL), the calculation would look as follows:

$$\text{Dobutamine infusion rate (mL/hour)} = \frac{2.5 (\text{micrograms/kg/minute}) \times 70 (\text{kg}) \times 60 (\text{minutes})}{1,000 \times 5 (\text{mg/mL})} = 2.1 \text{ mL/hour}$$

FLUSHING:

Do not flush. After completion of infusion: Disconnect giving set, aspirate cannula contents and then flush with sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Monitoring:

Administration of dobutamine should preferably be confined to a critical care setting with invasive haemodynamic monitoring.⁽⁵⁾ Hypovolaemia should be corrected before commencing therapy with dobutamine.^{(1a)(3)}

Monitor heart rate, blood pressure, urine flow, and if possible, cardiac output during therapy.^(1a-c)

Resuscitation equipment must be immediately available.

Adverse effects:

Tachycardia, ectopics, arrhythmias, hypertension, hypotension, phlebitis.⁽¹⁾⁽⁵⁾

If an undue increase in heart rate or systolic blood pressure occurs, or if an arrhythmia is precipitated, the doctor should be informed and consideration should be given to reducing the dose of dobutamine or discontinuing the drug temporarily.^(1a)

Tolerance may develop with continuous infusions longer than 72 hours requiring an increase in dose.^(1a,5)

EXTRAVASATION:

Extravasation can cause local inflammatory changes and phlebitis.^(1a) Administer via a central venous access device if possible. If extravasation occurs refer to local treatment protocols.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

The concomitant administration of dobutamine and other medicines via a Y-site should be avoided if possible to prevent inadvertent bolus administration of dobutamine.

Compatible (it is assumed that medicines meet close to the vascular access device):

Acetylcysteine, adrenaline, alfentanil, amiodarone, atracurium, calcium chloride, calcium gluconate, cisatracurium besylate, clonidine, dopamine, fentanyl citrate, glyceryl trinitrate, labetalol, lidocaine, magnesium sulphate, milrinone, morphine sulphate, noradrenaline, potassium chloride, propofol, remifentanil, vasopressin.⁽⁴⁾

Acetylcysteine, alfentanil, aprotinin, dopexamine.⁽¹⁴⁾

Other compatible diluents: Sodium chloride 0.45% and glucose 5%,^(1a,b,c) sodium chloride 0.9% and glucose 5%,^(1b,c) glucose 10%⁽³⁾ and Hartmann's.⁽¹⁴⁾

Incompatible: Aciclovir, alteplase, aminophylline, furosemide, heparin, sodium bicarbonate, Tazocin, thiopental.⁽⁴⁾

Digoxin, hydrocortisone, omeprazole, phenytoin.⁽¹⁴⁾

SPECIAL HANDLING PRECAUTIONS:

None⁽⁸⁾

SODIUM CONTENT (mmol):

Ready to use 250mg/50mL vial: 3.06mg/mL i.e.153mg (6.7mmol) sodium per vial.^(9a)
250mg/20mL ampoule: 0.72mg/20mL^(9a)
250mg/20mL ampoule: 0.97mg/20mL^(9b)

OSMOLARITY / OSMOLALITY:

Ready to use 250mg/50mL vial: 270 to 310 mOsmol/kg^(9a)

pH:

Ready to use 250mg/50mL vial: 3.0-4.5^(9a)
250mg/20mL ampoule: 2.5 – 5.5^{(9a)(9b)}
0.5mg/mL: 4.5 (in sodium chloride 0.9%), 4.2 (in glucose 5%).⁽¹³⁾
1.0mg/mL: 4.3 (in sodium chloride 0.9%), 4.1 (in glucose 5%).⁽¹³⁾. See link.

OTHER COMMENTS:

1. Do not mix with agents or diluents containing both sodium metabisulphite and ethanol.⁽¹⁾
2. Wockhardt distributing Hameln product, contact Hameln for all drug related enquiries.

REFERENCES:

1. Summary of Product Characteristics
 - a) Dobutamine 5mg/mL, Hameln. Last revised 13/02/2006
 - b) Dobutamine 250mg/20mL, Hameln. Last revised 16/12/1994
 - c) Dobutamine 250mg/20mL, Goldshield. Last revised 11/05/2010
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com on 01.02.2011
3. American Hospital Formulary Service Drug Information, accessed via www.medicinescomplete.com on 01.02.2011
4. Trissel "Handbook on injectable drugs" 15th Edition pg 528 -539
5. British National Formulary No 60, p136
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
 - 6a) British National Formulary for Children 2010-11
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
9.
 - a) Drug company: Hameln Pharmaceuticals Ltd. Date contacted: October 2010
 - b) Drug company: Goldshield. Date contacted: February 2011
10. UKCPA Critical Care Group. Minimum infusion volumes for fluid restricted critically ill patients. 3rd ed. 2006 accessed online via www.ukcpa.org.uk on 25.1.2011
11. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
12. Intensive Care Society website statement supporting use of standard infusion concentrations (2010) [See Link](#)
13. Quality Assurance department, Pharmacy Charing Cross Hospital (Imperial College Healthcare NHS Trust)

14. Handbook of Drugs in Intensive Care, 4th Edition, Paw H and Shulman R.

Version 3

Intravenous

Dopamine hydrochloride

MEDICINE NAME:

Dopamine hydrochloride

TRADE NAME(S):

Generic (Hospira, Goldshield, Martindale Pharma)

PRESENTATION OF MEDICINE:

Ampoules containing dopamine hydrochloride concentrate for dilution:

200mg in 5mL ^{(1a)(1b)(1d)}

800mg in 5mL ^{(1c)(1d)}

METHOD OF ADMINISTRATION:

IV infusion: To be administered by continuous IV infusion only after dilution with a suitable diluent. ^(1a)

Infuse, preferably via a central venous access device to avoid potential venous irritation as the product has a high osmolarity. ^{(1b)(1c)(1d)(2)(3)(4)} Administer using an infusion pump. ^{(1b)(1c)(1d)(3)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

For peripheral administration dilute 400mg in 250mL in sodium chloride 0.9% or glucose 5% to produce a solution of 1.6mg in 1mL. ^{(1b)(1c)(1d)(10)}

For administration via a central venous access device dilute 200mg to 50mL in sodium chloride 0.9% or glucose 5% to produce a solution of 4mg in 1mL. This is the standard concentration endorsed by the Intensive Care Society 'Standards' Committee. ⁽¹¹⁾
Concentrations of 8mg in 1mL may also be used. ⁽¹¹⁾

For use in children a maximum concentration of 3.2mg per 1mL should be used. If higher concentrations are necessary administration should be via a central venous access device. ^(6a)

Within neonatal intensive care a maximum concentration of 30mg/kg should be diluted to a final volume of 50mL. ^(6a)

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Solution is stable for 24 hours after dilution. ^{(1a)(1d)(3)}

EXAMPLE CALCULATION:

Infusion rate: The infusion rate can be calculated from the following equation:

$$\text{Dopamine infusion rate (mL/hour)} = \frac{\text{Dose (micrograms/kg/minute)} \times \text{patient weight (kg)} \times 60 \text{ (minutes)}}{1,000 \times \text{concentration (mg/mL)}}$$

For example: To administer a dose of 3micrograms/kg/minute of dopamine to a 70kg patient using a standard solution of 200mg in 50mL (4mg in 1mL), the calculation would look as follows:

$$\text{Dopamine infusion rate} = \frac{3 \times 70 \times 60}{1,000 \times 4} = 3.1 \text{ mL/hour}$$

FLUSHING:

IV infusion via a central venous access device: Do not flush the central venous access device. After the infusion is discontinued, disconnect the administration set, aspirate the cannula contents and then flush with sodium chloride 0.9%.

IV infusion via peripheral cannula: Flush the cannula with sodium chloride 0.9% at the same speed as the rate of infusion to avoid adverse haemodynamic effects.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Invasive haemodynamic monitoring required.⁽⁵⁾
2. It is advisable to monitor urine output if dose exceeds 50micrograms/kg/minute.^(1a)
3. Common cardiovascular reactions including ectopic heartbeats, tachycardia, hypotension, vasoconstriction.^(1a-d)
4. Gangrene of the feet has been reported following doses of 10-14micrograms/kg/minute and higher in patients with pre-existing vascular disease.^(1a)

EXTRAVASATION:

Extravasation of dopamine causes local vasoconstriction leading to severe tissue hypoxia and ischaemia; sloughing and necrosis may occur. Ischaemia may be reversed by infiltration of the affected area with 10-15mL sodium chloride 0.9% containing 5 to 10mg phentolamine mesylate. A syringe with a fine hypodermic needle should be used to liberally infiltrate the ischaemic area as soon as extravasation is noted.^(1a-d)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Amiodarone,⁽⁴⁾ calcium chloride,⁽⁴⁾ ciprofloxacin,⁽⁴⁾ dobutamine,⁽⁴⁾ fentanyl,⁽⁴⁾ glyceryl trinitrate,⁽⁴⁾ heparin,⁽⁴⁾ metronidazole,⁽⁴⁾ noradrenaline (norepinephrine),⁽⁹⁾ potassium chloride,⁽⁴⁾ propofol,⁽⁴⁾ vecuronium.⁽⁴⁾

Incompatible: Aciclovir,⁽⁴⁾ alteplase,⁽²⁾⁽⁴⁾ ampicillin (in glucose 5%),^{(1a)(9)} amphotericin (in glucose 5%),^{(1a)(4)} furosemide,⁽²⁾⁽⁹⁾ gentamicin,⁽⁴⁾ insulin,⁽²⁾⁽⁴⁾ iron salts,^{(1b)(1c)} sodium bicarbonate,^{(1a-c)(2)(3)(4)} thiopental sodium,⁽²⁾⁽⁹⁾

Do not infuse dopamine with sodium bicarbonate or other alkaline substances since dopamine is inactivated in alkaline solution.^{(1a-c)(2)(3)(5)}

Other compatible diluents to those listed above: Glucose 5% and sodium chloride 0.9%,^{(1b)(1c)} glucose 5% and sodium chloride 0.45%,^(1a-c) glucose 5% in Ringer lactate solution,^{(1b)(1c)} lactated Ringer's Injection,^{(1b)(1c)} compound sodium lactate infusion (Hartmann's solution).^{(1a)(5)}

SODIUM CONTENT (mmol):

200mg in 5mL (Hospira UK Ltd):^(9a) 0.105mmol per 1mL

200mg in 5ml (Goldshield):^(9b) 0.526mmol per 1mL

40mg in 1mL (UCB):^(9c) 0.42mmol per 1mL

40mg in 1mL (Martidale Pharma):^(9d) 0.105mmol per 1mL

OSMOLARITY / OSMOLALITY:

The osmolality of dopamine hydrochloride 40mg/mL was determined to be 619mOsm/kg by freezing-point depression and 581mOsm/kg by vapour pressure.⁽⁴⁾

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a high osmolality.

pH:

Hospira, Goldshield and UCB products: 2.5 to 5.5^(9a-c)

Martindale products: 3.0 to 5.0^(9d)

OTHER COMMENTS:

1. Do not use infusion if discoloured.^{(1a-c)(4)}
2. Store in original outer container to protect from light.^(1a-c) Light protection not required during administration.
3. The following link alerts users to products on a current National Purchasing Contract which have been assessed by the NHS Pharmaceutical Quality Assurance service as having a HIGH or MEDIUM medication error potential. See Caution in use of dopamine.

REFERENCES:

1. Summary of Product Characteristics
 - a) Dopamine 40mg/mL Sterile Concentrate (Hospira UK Ltd) last updated 23 August 2010
 - b) Sterile Dopamine Concentrate 200mg/5mL (Goldshield), last updated 17 August 2010
 - c) Sterile Dopamine Concentrate 800mg/5mL (Goldshield), last updated 17 August 2010
 - d) Sterile Dopamine Concentrate 200mg/5mL (Martindale Pharma) last updated May 2001
 - e) Sterile Dopamine Concentration 800mg/5mL (Martindale Pharma) last updated May 2001
2. Martindale" accessed via <http://www.medicinescomplete.com> on 15/10/2010
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 15/10/2010
4. Trissel " Handbook on injectable drugs" 15th Edition
5. British National Formulary No. 60, September 2010
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2010-11
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
 - a) Hospira UK Ltd, last revised 21 June 2002
 - b) UCB Pharma, last revised 10 November 2005
9.
 - a) Drug company name: Hospira UK Ltd. Date contacted: 28 October 2010
 - b) Drug company name: Goldshield. Date contacted: 28 October 2010
 - c) Drug company name: UCB Pharma. Date contacted: 28 October 2010
 - d) Drug company name: Martindale Pharma. Date contacted: 29 October 2010
10. Dopamine: Procedure for the specialist intravenous administration in adults, September 2008, University Hospitals of Leicester NHS Trust
11. Standard concentrations for infusions used in critical care areas. The Intensive Care Society website (2010) [See Link](#)

Intravenous

Doxapram hydrochloride

MEDICINE NAME:

Doxapram hydrochloride

TRADE NAME(S):

Doxapram injection (generic) (MercuryPharma)

PRESENTATION OF MEDICINE:

Ampoules containing 100mg doxapram in 5mL (ie. 20mg per mL).

METHOD OF ADMINISTRATION (adult):

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹⁰⁾ If a central venous access device is unavailable, a risk benefit analysis should be made on an individual patient basis.

ADULT

Post-operative respiratory depression

IV injection: give over at least 30 seconds. Dose may be repeated at one hourly intervals.^(1a)

IV infusion via an infusion pump (unlicensed): Infusion rates of 2 to 3mg per minute are recommended. Adjust dose according to response.^{(1b)(2)}

Acute respiratory failure

IV infusion via an infusion pump (unlicensed): Give at a rate of 1.5mg to 4mg per minute. Adjust dose according to response. Give concurrently with oxygen and monitor blood gases.^{(1b)(2)}

CHILD

Not licensed and not recommended.⁽⁶⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

IV injection: No dilution required.

IV infusion (unlicensed): Dilute the 20mg/mL injection with glucose 5% or sodium chloride 0.9% to a suggested concentration of 2mg/mL (e.g. dilute 400mg [4 x 100mg ampoules] in 180mL infusion fluid).⁽³⁾

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

24 hours⁽⁹⁾

EXAMPLE CALCULATION (adult):

Infusion rate: The infusion rate can be calculated from the following equation:

$$\text{Doxapram infusion rate (mL/hour)} = \frac{\text{Dose (mg/minute)} \times 60 \text{ (minutes)}}{\text{concentration (mg/mL)}}$$

For example: To give at a rate of 3mg/minute of using a solution diluted to a strength of 2mg in 1mL, the calculation would look as follows::

$$\text{Doxapram infusion rate} = \frac{3 \text{ (mg/minute)} \times 60 \text{ (minutes)}}{2 \text{ (mg/mL)}} = 90 \text{ mL/hour}$$

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.⁽³⁾⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

Pyrexia, sweating, flushing, headache, dizziness, tachycardia, hypertension. May stimulate vomiting.^(1a) Discontinue if sudden and severe hypertension or dyspnoea develops, or if oxygen tension decreases, or mechanical ventilation is initiated.⁽³⁾

Monitoring:

Monitor blood pressure, heart rate and deep tendon reflexes to prevent over dosage and adjust dose or rate of infusion on the basis of these measurements.^{(1a)(3)}

Monitor arterial blood gases prior to and at 30 minute intervals during administration to prevent respiratory acidosis.⁽³⁾

Respiratory depression caused by depressant drugs may recur after administration of doxapram; observe patient closely until they have been fully alert for 30 to 60 minutes.^{(1a-b)(3)}

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to low pH. Preferably administer via a central venous access device. Monitor injection site closely.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

When giving by IV injection do not administer via an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

Compatible infusions (it is assumed the medicines meet close to the venous access device): Doxapram infusion 2mg/mL in glucose 5% is visually compatible with erythromycin lactobionate, fentanyl, gentamicin, ranitidine, phenobarbital and vancomycin (all also in glucose 5%).⁽⁴⁾

Ampicillin in sodium chloride 0.9%⁽⁴⁾

Heparin sodium and insulin in sodium chloride 0.45%.⁽⁴⁾

Calcium chloride, ceftazidime, metoclopramide and metronidazole (infusion fluid not stated).⁽⁴⁾

Doxapram 400mg/20mL is compatible with terbutaline 0.2mg/mL, and bumetanide 0.5mg/mL when mixed in the same syringe.⁽⁴⁾

Compatible infusion fluids: Glucose 5%, glucose 10% and sodium chloride 0.9%.⁽⁴⁾

Incompatible: Doxapram is reported to be incompatible with alkaline drugs e.g. aminophylline,^{(1a-b)(3)} sodium bicarbonate,⁽³⁾ thiopental,^{(1a-b)(2)(3)} folic acid,⁽⁴⁾ and furosemide.^{(1a-b)(2)} Also incompatible with cefotaxime, cefuroxime, clindamycin, dexamethasone, digoxin, dobutamine, hydrocortisone, ketamine, and methylprednisolone.⁽⁴⁾

SODIUM CONTENT (mmol):

None⁽⁹⁾

OSMOLARITY / OSMOLALITY:

96.4mOsm/L (undiluted)⁽¹²⁾ 260-287mOsm/L (diluted to 2mg in 1mL in glucose 5% or sodium chloride 0.9%)⁽¹²⁾

pH:

3.5 to 5⁽⁹⁾

OTHER COMMENTS:

1. Store injection below 25°C .^(1a) Do not refrigerate.^(1a)
2. September 2013: Doxapram 1g in 500mL in glucose 5% solution for infusion has been discontinued expiry date of last batch produced: (B/N: 11G20BN): 30th June 2013), however the SPC is still available via the eMc website.

REFERENCES:

1. Summary of Product Characteristics
 - a) Doxapram hydrochloride BP 20mg/mL solution for injection, Mercurypharma (Supplier; Amdipharm Mercury), last revised September 2013
 - b) Doxapram Solution for Infusion, MercuryPharma (Supplier Amdipharm Mercury) last revised March 2012. September 2013 Product discontinued but SPC remains on eMc
2. Martindale accessed via <http://www.medicinescomplete.com> on 22/05/2013
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 22/05/2013
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 23/05/2013
5. British National Formulary May 2013 accessed via <http://www.medicinescomplete.com> on 23/05/2013
6. British National Formulary for Children May 2013 accessed via <http://www.medicinescomplete.com> on 23/05/2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by the manufacturer - not available
9. Drug company name: Supplier: Amdipharm Mercury Company Ltd. Date contacted: 20/05/2013, 24/05/2013
10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
11. UCLH Injectable Medicines Administration Guide, 3rd Edition, 2010
12. Imperial College Healthcare NHS Trust, QA Department. Date contacted: 04/07/2013

Version 5

Intravenous

Dried prothrombin complex (Beriplex P/N)

The batch number and expiry date of the product administered should be recorded as per the local protocol.

MEDICINE NAME:

Dried prothrombin complex (Beriplex® P/N)
(Human Prothrombin Complex)

TRADE NAME(S):

Beriplex® P/N

PRESENTATION OF MEDICINE:

One vial of human prothrombin complex 250 International Units (IU) (250 IU Factor IX) powder plus one vial of 10mL solvent (water for injections) for reconstitution. One filter transfer device 20/20 also provided.⁽¹⁾

One vial of human prothrombin complex 500 International Units (500 IU Factor IX) powder plus one vial of 20mL solvent (water for injections) for reconstitution. One filter transfer device 20/20 also provided.⁽¹⁾

Beriplex® P/N also contains factors II, VII and X.⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection :

Give by slow IV injection using a dedicated infusion line at a rate not more than 3 International Units/kg/minute of factor IX. Maximum rate 210 International Units/minute of factor IX.⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute each vial with the solvent (water for injections) provided using the Mix2vial reconstitution device.⁽¹⁾

Gently swirl the product vial until the substance is fully dissolved. Do not shake.⁽¹⁾

Follow the instructions in the package insert carefully when using the reconstitution device. The vials should be placed on an even and firm surface when attaching the device.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Do not further dilute the product.⁽¹⁾

Stability:

Prepare immediately before administration.

FLUSHING:

Sodium chloride 0.9%.⁽⁹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effect:

Thrombotic events (including disseminated intravascular coagulation), headache, pyrexia, hypersensitivity reactions (including anaphylaxis).⁽⁵⁾

Monitoring:

If allergic-anaphylactic reactions occur, discontinue the Beriplex® P/N and treat the reaction as per local policy.⁽¹⁾

Patients should be observed closely for signs or symptoms of disseminated intravascular coagulation or thrombosis.⁽¹⁾

Ensure that no blood enters the syringe filled with the product as there is a risk of clotting.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

The reconstituted solution should be administered by a separate infusion line.⁽¹⁾

SODIUM CONTENT (mmol):

Approximately 0.15mmol/mL.⁽¹⁾

OSMOLARITY / OSMOLALITY:

150 to 250mOsmol/kg.⁽⁹⁾

pH:

6.5 to 7.5.⁽⁹⁾

OTHER COMMENTS:

1. Do not store above 25°C.⁽¹⁾
2. Do not freeze.⁽¹⁾
3. Keep the vial in the outer container, in order to protect from light.⁽¹⁾
4. Excipients:
Powder: Heparin, human albumin, human antithrombin III, sodium chloride, sodium citrate, hydrochloride or sodium hydroxide (in small amounts for pH adjustment).
Solvent: water for injections.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics. Beriplex®, last revised 28/07/2011
2. Martindale "The Complete Drug Reference" accessed via www.thomsonhc.com, April 2011
3. American Hospital Formulary Service Drug Information"
4. Trissel "Handbook on injectable drugs" 15th Edition
5. British National Formulary No. 61, March 2011, pg 159
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2010-11
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacture, CSL Behring 09/01/2010r
9. Drug company name: CLS Behring
Date contacted: April 2011

Intravenous

Ephedrine hydrochloride

MEDICINE NAME:

Ephedrine hydrochloride

TRADE NAME(S):

Ephedrine hydrochloride (Auden McKenzie Ltd)(Martindale)

PRESENTATION OF MEDICINE:

3mg in 1mL preparations (ready diluted for administration):

Ampoules containing 30mg in 10mL solution for injection.^(1c)

Pre-filled syringes containing 30mg in 10mL solution for injection.^(1d)

30mg in 1mL preparation (requires dilution before administration):

Ampoules containing 30mg in 1mL solution for injection.^(1a-b)

METHOD OF ADMINISTRATION:

Slow IV injection: Administer as a 3mg in 1mL solution over 3-5 minutes. Doses can be repeated every 3-4 minutes as required, to a maximum dose of 30mg.⁽¹⁾⁽²⁾⁽⁵⁾

Children 1-12 years: Administer as a 3mg in 1mL solution by **slow IV injection** over 3-5 minutes via a central venous access device.^(6a)

INSTRUCTIONS FOR RECONSTITUTION:

Ready made 30mg/mL solution that requires dilution before administration. (See instructions for dilution and suitable diluent).

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Preferably use 3mg in 1mL solution which does not require further dilution.

Alternatively dilute the contents of the ephedrine 30mg in 1mL ampoules to a concentration of 3mg in 1mL with sodium chloride 0.9% or glucose 5%.⁽²⁾⁽⁵⁾⁽⁹⁾

STABILITY

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9% ⁽¹⁾⁽⁹⁾⁽¹⁰⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Tachycardia (more common) or bradycardia, arrhythmias, anginal pain, hypertension, dizziness, flushing, anxiety, restlessness, nausea, vomiting, headache, confusion.^{(1a-c)(10)}

EXTRAVASATION:

No information ^{(1a-c)(11)}

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

Compatible with the following diluents in addition to those listed above: Glucose 10%, glucose/sodium chloride, sodium lactate compound (Hartmanns).⁽¹⁰⁾
Incompatible: Anionic salts such as phosphate, carbonates and acetates.^(1a)

SODIUM CONTENT (mmol):

0.1mmol sodium per 30mg in 1mL ampoule ⁽⁹⁾
1.03mmol sodium per 30mg in 10mL ampoule.⁽⁹⁾⁽¹²⁾

OSMOLARITY / OSMOLALITY:

297mOsmol/L (Martindale 30mg in 1mL ampoule). See link⁽¹³⁾
307mOsmol/L (Martindale 30mg in 1mL ampoule diluted to 3mg in 1mL with sodium chloride 0.9%). See link ⁽¹³⁾.
235mOsmol/L (Martindale 30mg in 10mL ampoule).

pH:

5 to 7 (Martindale 30mg in 1mL ampoule undiluted).⁽⁹⁾
4.5 to 6.5 (Martindale 30mg in 1mL ampoule).⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Ephedrine, Auden McKenzie, last updated July 2009
 - b) Ephedrine 30mg/mL ampoule (Martindale), last revised July 2002
 - c) Ephedrine, 30mg/10mL ampoule (Martindale), last revised Feb 2009
 - d) Ephedrine 30mg;10mL pre-filled syringe (Martindale), last revised September 2005
2. Martindale accessed via <http://www.medicinescomplete.com> on 31/12/2010
3. American Hospital Formulary Service, Drug Information accessed via <http://www.medicinescomplete.com> on 31/12/2010
4. Trissel "Handbook on Injectable Drugs" accessed via <http://www.medicinescomplete.com> on 31/12/2010
5. British National Formulary No 60 accessed via www.bnf.org.uk on 31/12/2010
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003
 - a) British National Formulary for Children 2010-11 accessed via www.bnfc.org.uk on 31/12/2010
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
9. Drug company name: Martindale Pharmaceuticals Ltd
Date contacted: 31/12/2010
10. UCLH Injectable Medicines Administration Guide, 3rd Edition, 2010
11. National Extravasation Service accessed via www.extravasation.org.uk on 31/12/2010
12. Calculated by K Thakrar (Medicines Governance Pharmacist, UCLH) with information provided from Martindale.
13. Calculated by Peter Cowin (Deputy QA Manager, Charing Cross Hospital, Imperial College Healthcare NHS Trust)

Intravenous

Ertapenem

Contains a PENICILLIN-like structure

MEDICINE NAME:

Ertapenem

TRADE NAME(S):

Invanz[®]

PRESENTATION OF MEDICINE:

Vials containing ertapenem 1g powder.⁽¹⁾

METHOD OF ADMINISTRATION:

IV infusion: Infuse over a period of 30 minutes.⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute the contents of a 1g vial with 10mL water for injections or sodium chloride 0.9% to obtain a solution of approximately 100mg ertapenem in 1mL. Shake the vial well to dissolve. Dilute the reconstituted solution immediately after preparation (see below).⁽¹⁾

Reconstituted solutions of ertapenem range from colourless to pale yellow.⁽¹⁾

DISPLACEMENT VALUE:

Negligible⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Ertapenem should be diluted further with sodium chloride 0.9%.⁽¹⁾
N.B Incompatible with glucose solutions⁽¹⁾.

For adults and children 13 years of age and older:⁽¹⁾

If using a **50mL bag** of sodium chloride 0.9%: Add the contents of the reconstituted vial to the bag.

If using a **50mL vial** of sodium chloride 0.9%: Withdraw 10mL from the sodium chloride 0.9% vial and discard. Transfer the contents of the reconstituted 1g vial of ertapenem to the 50mL sodium chloride 0.9% vial.

For children 3 months to 12 years of age:

The final concentration of the diluted solution must be less than 20mg per 1mL.⁽¹⁾

For information on minimum final volume of infusion for different doses, see link.

STABILITY

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9%.⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Hypersensitivity reactions: discontinue immediately at the first appearance of a rash or any other sign of hypersensitivity.⁽¹⁾

2. Nausea, vomiting, headache, dizziness and drowsiness.⁽¹⁾
3. Phlebitis/thrombophlebitis.⁽¹⁾
4. Infusion site erythema, warmth, pain, burning or pruritis.⁽¹⁾
5. Confusion, insomnia, seizure.⁽¹⁾

EXTRAVASATION:

No reports of tissue damage following extravasation registered with the manufacturer⁽⁹⁾ however phlebitis/thrombophlebitis and infusion site pain are reported.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device and not in an infusion bag, burette or syringe): Heparin sodium, hetastarch in sodium chloride 0.9%, potassium chloride, tigecycline.⁽⁴⁾

Incompatible: Anidulafungin, caspofungin, compound sodium lactate injection, glucose solutions, Ringer's solution for injection, mannitol solutions, sodium bicarbonate 5%, sodium lactate, all other drugs.⁽¹⁾⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

Avoid contact with eyes, skin and clothing. Wash thoroughly with soap and water after contact. Direct contact with eyes may cause irritation. Flush with water for at least 15 minutes.⁽⁸⁾

SODIUM CONTENT (mmol):

6mmol per 1g vial.⁽¹⁾⁽⁵⁾

OSMOLARITY / OSMOLALITY:

378mOsm/L (1g reconstituted with 10mL sodium chloride 0.9% and added to 50mL sodium chloride 0.9%).⁽¹⁰⁾

Ertapenem osmolality calculation, see link.

pH:

7.5 when reconstituted and diluted in sodium chloride 0.9%.⁽⁹⁾

OTHER COMMENTS:

1. Contraindicated if prior severe hypersensitivity reaction (e.g. anaphylactic reaction, severe skin reaction) to any other type of beta-lactam antibacterial agent (e.g. penicillins or cephalosporins).⁽¹⁾
2. Contraindicated in hypersensitivity to ertapenem or any other carbapenem antibacterial.⁽¹⁾
3. The formulation of Invanz® does not contain latex, but the manufacturer cannot guarantee that the product has not come into contact with latex during manufacture.⁽⁹⁾
4. Caution is advised in patients with known or suspected CNS disorders.⁽¹⁾
5. Infusion expiry 6 hours at room temperature.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Invanz 1g powder for concentrate for solution for infusion. Date of revision of text July 2010
2. Martindale accessed via <http://www.medicinescomplete.com> on 02/03/2011
3. American Hospital Formulary Service Drug Information" accessed via <http://www.medicinescomplete.com> on 02/03/2011
4. Trissel "Handbook on injectable drugs" 16th Edition accessed via <http://www.medicinescomplete.com> on 02/03/2011
5. British National Formulary No. 60, September 2010, pg 337
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2010-11
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer. Safety Data Sheet Invanz (Ertapenem for Injection) Merck & Co Inc. 03/01/2008
9. Drug company name: Merck Sharpe and Dohme Ltd
Date contacted: 11/03/2011
10. P. Cowin, Deputy QA Manager, Charing Cross Hospital. Date contacted: 15/03/2011

Version 3 (NHS Lothian local amendment)

Intravenous

Erythromycin lactobionate

MEDICINE NAME:

Erythromycin lactobionate

TRADE NAME(S):

Erythrocin®

PRESENTATION OF MEDICINE:

Vials containing erythromycin 1g (as lactobionate) powder for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION:

Continuous IV infusion: Give via an infusion pump.

IV infusion: Give over 20 to 60 minutes every 6 hours.⁽¹⁾

If concentrations greater than 5mg/mL are needed (e.g. in fluid restricted patients) give via a central venous catheter device over 30 to 60 minutes.⁽¹¹⁾

Concentrations of up to 1g in 100mL via a central venous access device over 30 to 60 minutes have been used.⁽¹¹⁾

Do not give by IV injection.⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute vials with 20mL water for injections to produce a solution containing 50mg/mL.

Requires further **dilution before administration.**⁽¹⁾

DISPLACEMENT VALUE:

The vial contains overage and displacement is allowed for and only 20mL need be withdrawn to obtain a 1g dose ⁽⁹⁾⁽¹⁰⁾⁽¹¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Prepare the infusion with sodium chloride 0.9%, sodium lactate, compound (Hartmann's) or buffered glucose 5%.⁽¹⁾ If glucose 5% is used it should be buffered by adding 5mL of sodium bicarbonate 8.4% solution to each litre of glucose 5%.⁽¹⁾

Continuous IV infusion: Dilute the reconstituted solution to a concentration not exceeding 2mg/mL (e.g. 1g to a minimum of 500mL).⁽¹⁾

IV infusion over 20-60 minutes: Dilute the reconstituted solution to a concentration not exceeding 5mg/mL (e.g. add 1g in at least 200mL of infusion fluid).⁽¹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

The infusion should be completed within 8 hours of preparation to ensure potency.⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Allergic reactions.⁽¹⁾
2. Hypersensitivity reactions, arrhythmias and hypotension (associated with rapid infusion),⁽²⁾ abdominal discomfort, cramp, nausea, vomiting, diarrhoea, thrombophlebitis, venous irritation.⁽¹⁾
3. If concentrations greater than 5mg/mL are needed (e.g. in fluid restricted patients) , cardiac monitoring is recommended because of the possibility of arrhythmias at high concentrations.⁽¹¹⁾
4. The manufacturers recommend that concentrations used should not exceed 5mg in 1mL as higher strengths may cause phlebitis.⁽¹⁾

EXTRAVASATION:

No information.⁽⁹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Erythromycin infusion is compatible with the following infusions (it is assumed that medicines meet close to the vascular access device): Aciclovir,⁽⁴⁾ aminophylline,⁽⁴⁾ amiodarone (in glucose 5%),⁽⁴⁾ bivalirudin,⁽⁴⁾ doxapram,⁽⁴⁾ esmolol,⁽⁴⁾ levofloxacin,⁽⁴⁾ magnesium sulfate,⁽⁴⁾ midazolam,⁽⁴⁾ morphine sulfate,⁽⁴⁾ noradrenaline⁽¹²⁾ zidovudine.⁽⁴⁾

Compatible infusion fluids:

Compound sodium lactate (Hartmann's solution), buffered glucose 5%, sodium chloride 0.9%, buffered sodium chloride 0.18% with glucose 4%.⁽¹⁾

Incompatible: Acetylcysteine,⁽²⁾ amikacin,⁽⁴⁾ ceftazidime,⁽⁴⁾ colistin, flucloxacillin,⁽⁴⁾ fluconazole,⁽⁴⁾ furosemide,⁽⁴⁾ gentamicin, heparin, linezolid,⁽⁴⁾ metaraminol,⁽⁴⁾ rocuronium bromide⁽⁴⁾

The following are usually incompatible, infuse separately if possible: Blood components, parenteral nutrition solutions, phosphate preparations, plasma substitutes, sodium bicarbonate infusions.

SODIUM CONTENT (mmol):

Nil⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Osmolality of 223mOsm/kg (reconstituted solution).⁽⁴⁾⁽¹⁰⁾

pH:

pH 6.5 to 7.5 (reconstituted solution).⁽⁴⁾

REFERENCES:

1. Summary of Product Characteristics, Erythrocin IV Lactobionate injection, Amdipharm. Date of revision of text April 2012.
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com on 30/03/2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 30/03/2012
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com on

30/03/2012

5. British National Formulary No. 63 March 2012 pg 372
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012 pg 283
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. Safety Data Sheet compiled by Hospira UK Ltd. Date of preparation 01 May 2002
9. Drug company name: Amdipharm; Date contacted: 03 April 2012
10. Bard website, www.accessability-by-bard.co.uk. Date accessed 03/04/2012
11. UKCPA critical pharmacists: Minimum Infusion Volumes for fluid restricted critically ill patients. 4th edition December 2012
12. Handbook of Drugs in Intensive Care, 4th Edition, Paw H and Shulman R

Version 3

Intravenous

MEDICINE NAME:

Esomeprazole

Esomeprazole

TRADE NAME(S):

Nexium®

Esomeprazole (IBIGEN S. r. l - supplier Bowmed Ibisqus Ltd; Sun Pharmaceuticals UK Ltd)

PRESENTATION OF MEDICINE:

Vials containing esomeprazole 40mg (as sodium salt) powder for reconstitution.^(1a-c)

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3 to 5 minutes.^(1a-c)

IV infusion: Administer over 10 to 30 minutes.^(1a-c)

Continuous IV infusion over 72 hours: Administer 80mg by initial IV infusion over 30 minutes followed by a continuous IV infusion of 8mg/hour for 71.5 hours.^{(1a-c)(11)(12)}

After administration of initial intravenous dose of 80mg esomeprazole, the contents of two 40mg vials are dissolved in up to 100mL of 0.9% sodium chloride and given at a rate of 8mg/hour (i.e. over 10 hours). This is repeated with fresh vials after that time.^(1a-c)

Due to extreme pH preferably administer via a central venous access device.⁽¹³⁾

If a central venous access device is unavailable, a risk benefit analysis should be made on an individual patient basis. If given peripherally, the insertion site must be monitored closely for phlebitis using a recognised infusion phlebitis scoring tool.⁽¹³⁾

INSTRUCTIONS FOR RECONSTITUTION:

Add 5mL sodium chloride 0.9% to the 40mg vial.^(1a-c)

The reconstituted solution should be inspected visually for particulate matter and discolouration, prior to administration. Only clear solution should be used. The reconstituted solution for injection is clear and colourless to very slightly yellow.^{(1a-c)(10)}

DISPLACEMENT VALUE:

Nil⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: Dilute the required dose with up to 100mL sodium chloride 0.9%.^{(1a-c)(5)}

Continuous IV infusion: Dilute 80mg with 100mL sodium chloride 0.9%.^{(1a-c)(12)}

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Use immediately after reconstitution.^(1a-c)

Continuous IV infusion: Esomeprazole 80mg in 100mL solutions in use are stable for 12 hours at 25°C^(1b) and 30°C.^{(1a)(1c)}

FLUSHING:

IV injection: Flush with sodium chloride 0.9%

IV infusion: Flush with sodium chloride 0.9%

Continuous IV infusion: Flush with sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypersensitivity reactions have been reported e.g. fever, angioedema and anaphylactic reactions/shock.^(1a-c) Local reaction at injection site.^(1a-c)

Adverse effects reported with IV esomeprazole generally are similar to those reported with oral esomeprazole.⁽³⁾

EXTRAVASATION:

No specific recommendation issued by the manufacturer.

If extravasation occurs, refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device): No information.

Incompatible: No information

IV injection: When giving by IV injection do not administer via an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

IV infusion and continuous IV infusion: Do not infuse with any other medicines or infusions.^{(1a-c)(3)}

SPECIAL HANDLING PRECAUTIONS:

No special precautions are necessary when handling product. In case of vial breakage or spillage, avoid contact with skin and eyes. Do not breathe dust. Ensure adequate ventilation. Use suitable personal protection during removal of spillages.^(8a-c)

SODIUM CONTENT (mmol):

Each vial contains less than 1mmol sodium.^{(1a)(1c)(9b)}

OSMOLARITY / OSMOLALITY:

The reconstituted solution is isotonic with an osmolality of approximately 300mOsm/L.^(9a)

The reconstituted solution in 100mL sodium chloride 0.9% has an osmolality of approximately 304mOsm/kg.^(1b)

The reconstituted solution in 100mL sodium chloride 0.9% has an osmolality of 270-330mOsm/kg.^(9c)

pH:

The pH of esomeprazole 40mg reconstituted with 100mL of sodium chloride 0.9% is 9.3 to 10.3.^(9a)

The pH of esomeprazole 40mg reconstituted with 100mL of sodium chloride 0.9% is 9.6.^(1b)

The pH of esomeprazole 40mg reconstituted with 100mL of sodium chloride 0.9% is 9.0-11.0.^(1c)

REFERENCES:

- Summary of Product Characteristics
 - Nexium IV (Astra Zeneca). Last revised 10/10/2012
 - Esomeprazole (Bowmed Ibisqus Ltd). Last revised 19/04/2012
 - Esomeprazole (Sun Pharmaceuticals Ltd). Last revised 22/11/2011
- Martindale accessed via <http://www.medicinescomplete.com> on 08/12/2011

3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 08/12/2011
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 08/12/2011
5. British National Formulary No. 64 September 2012, pg 56 and 988
6. Medicines for Children produced by the Royal College of Paediatrics and Child Health 2003
 - a) British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011.](#)
8. COSHH report compiled by the manufacturer
 - a) Astra Zeneca: Version 4.1 (revised 21/12/2010)
 - b) Bowmed Ibisqus
 - c) Sun Pharmaceuticals Ltd
9.
 - a) Drug company name: AstraZeneca UK Ltd. Date contacted: December 2011
 - b) Drug company name: Bowmed Ibisqus Ltd. Date contacted: September 2012
 - c) Drug company name: Sun Pharmaceuticals Ltd. Date contacted: September 2012
10. Lexi-comp ONLINE accessed on 02/03/2012 [See Link](#)
11. UKMI Medicines Q&As. How should continuous infusions of branded proton pump inhibitors be given for acute upper gastrointestinal bleeding? Wessex Drug & Medicines Information Centre, published 24/11/2010 (see 'links' section above)
12. Intravenous esomeprazole for prevention of peptic ulcer re-bleeding: Rationale and design of Peptic Ulcer Bleed Study. Sung, JJY et al. Aliment Pharmacol Ther 2008; 27:666-677
13. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 4

Intravenous

Fentanyl

MEDICINE NAME:

Fentanyl

TRADE NAME(S):

Sublimaze®

Non-proprietary available from Auden McKenzie and Goldshield

PRESENTATION OF MEDICINE:

Ampoules containing fentanyl 100micrograms in 2mL and 500micrograms in 10mL (as fentanyl citrate).⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3-5 minutes.

IV infusion: Infuse using an infusion pump

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Adults: Standard concentration for infusion 50micrograms in 1mL (i.e. 2.5mg in 50mL).⁽¹⁰⁾
Can be diluted with glucose 5% or sodium chloride 0.9% if required ^{(1c)(2)(4)(5)}

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

24 hours when prepared in the clinical area ⁽²⁾⁽⁴⁾

EXAMPLE CALCULATION:

Infusion rate: The infusion rate can be calculated from the following equation:

$$\text{Fentanyl infusion rate (mL/hour)} = \frac{\text{Dose (nanograms/kg/minute)} \times \text{patient weight (kg)} \times 60 \text{ (minutes)}}{1,000 \times \text{concentration (microgram s/mL)}}$$

For example: To administer a dose of 50nanograms/kg/minute of fentanyl to a 70kg patient using a standard solution of 2.5mg in 50mL (50micrograms in 1mL), the calculation would look as follows:

$$\text{Fentanyl infusion rate} = \frac{50 \text{ (nanograms/kg/minute)} \times 70 \text{ (kg)} \times 60 \text{ (minutes)}}{1,000 \times 50 \text{ (microgram s/mL)}} = 4.2 \text{ mL/hour}$$

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

Fentanyl causes dose-dependent respiratory depression which can be reversed by naloxone. With high or repeated doses fentanyl becomes long-acting (due to redistribution into fat) and repeated doses of naloxone may be required. Respiratory depression may become apparent for the first time post-operatively when monitoring of the patient may be less intensive.⁽²⁾⁽⁵⁾

Muscle rigidity with rapid injection. This can be treated with neuromuscular blocking drugs,

or avoided by pre-treatment with benzodiazepines.^{(1a-b)(2)(3)(5)}

Transient hypotension, especially in hypovolaemic patients. Bradycardia, which can be controlled with atropine.⁽¹⁾⁽²⁾⁽³⁾⁽⁵⁾

Cough which can be reduced by giving the injection more slowly.⁽²⁾

Monitoring:

Monitor blood pressure, heart rate and respiratory rate and have naloxone and resuscitation equipment available.⁽¹⁾⁽²⁾

EXTRAVASATION:

Unlikely to cause a particular problem. Follow local extravasation protocols.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Adrenaline, amiodarone, atracurium, cisatracurium, clonidine, dobutamine, dopamine, esmolol, furosemide, glyceryl trinitrate, heparin sodium, hydrocortisone sodium succinate, labetalol, midazolam, milrinone, morphine, noradrenaline, pancuronium, potassium chloride infusion, propofol, remifentanyl, vecuronium.⁽⁴⁾

Acetylcysteine, alfentanil, aprotinin, calcium gluconate, dopexamine.⁽¹¹⁾

Incompatible: Phenytoin.⁽⁴⁾ Omeprazole, thiopental.⁽¹¹⁾

SODIUM CONTENT (mmol):

0.15mmol/mL⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information.⁽⁹⁾

pH:

3.5 to 7.5⁽⁹⁾

OTHER COMMENTS:

1. To reduce dosing errors with fentanyl, all healthcare practitioners should ensure they are familiar with the formulation, usual dose and side effects and that any prior administration of opioids has been taken into account.⁽¹⁾
2. Do not store above 25°C.⁽¹⁾
3. Protect from light / store in outer carton.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Sublimaze, Janssen-Cilag, last updated 18/01/2011
 - b) Fentanyl, Auden McKenzie, last updated 30/01/2011
 - c) Fentanyl, Goldshield, last updated 07/01/2011
2. Martindale accessed via www.medicinescomplete.com/mc on 10/05/2011
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com/mc on 10/05/2011
4. Trissel 'Handbook on injectable drugs' 16th Edition pg 669-677
5. British National Formulary No. 61 pg 786-7
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 pg 246-248
 - a) British National Formulary for Children 2010-11 pg 787-8

7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
 - a) Janssen-Cilag. Revision date 11/03/2011
 - b) Auden McKenzie. Revision date 26/01/2004
9. a) Drug company name: Janssen-Cilag. Date contacted: 19/07/2010 and 11/03/2011
 - b) Drug company name: Auden McKenzie. Date contacted: 08/03/2011
 - c) Drug company name: Goldshield. Date contacted: 08/03/2011
10. Standard concentrations for infusions used in critical care areas. The Intensive Care Society supports the adoption of standard concentrations. For details, go to the Intensive Care society website and see 'Medication Concentrations in Critical Care Areas (2010)' [See Link](#)
11. Handbook of Drugs in Intensive Care, 4th Edition, Paw H and Shulman R.
12. Reducing Dosing Errors with Opioid Medicines. Rapid Response Report
NPSA.2008/RRR05

Version 4

Intravenous

Ferric carboxymaltose (Ferinject)

Ferric carboxymaltose must be administered ONLY by the intravenous route.⁽¹⁾

The MHRA issued updated advice (see 'Method of Administration' below) on administration and monitoring of intravenous iron preparations dated August 2013 which is included in this monograph but may not be reflected in the package insert.⁽¹⁰⁾

MEDICINE NAME:

Ferric carboxymaltose

TRADE NAME(S):

Ferinject[®] (Vifor Pharma)

PRESENTATION OF MEDICINE:

Vial containing 100mg of iron (as ferric carboxymaltose) in 2mL⁽¹⁾

Vial containing 500mg of iron (as ferric carboxymaltose) in 10mL⁽¹⁾

Presented as a dark brown, non-transparent, aqueous solution⁽¹⁾

METHOD OF ADMINISTRATION:

The cumulative dose of ferric carboxymaltose must be calculated for each patient individually and must not be exceeded.⁽¹⁾ See below.

IV injection:

Ferric carboxymaltose may be administered by intravenous injection using undiluted solution up to 1000mg iron (up to a maximum of 15mg/kg body weight).⁽¹⁾

For doses greater than 200mg and up to 500mg iron, ferric carboxymaltose should be administered at a rate of 100mg/minute.⁽¹⁾

For doses greater than 500mg and up to 1000mg iron, ferric carboxymaltose should be administered over 15 minutes.⁽¹⁾

In patients on haemodialysis, a single maximum daily injection 200mg of iron may be given undiluted directly into the venous limb of the dialyser.⁽¹⁾

IV infusion: Give by intravenous infusion via an infusion pump up to a maximum single dose of 20mL (1000mg of iron) of ferric carboxymaltose (up to a maximum of 20 mg/kg body weight) in 250mL of sodium chloride 0.9% over 15 minutes.⁽¹⁾

Maximum Tolerated Dose:

A single dose of ferric carboxymaltose should not exceed 1000mg of iron (20mL) per day. Do not administer 1000mg of iron (20mL) more than once a week.⁽¹⁾ If the total dose is greater than 1000mg of iron, then it should be divided and given over two weeks.

Calculation of the Cumulative Dose:

The cumulative dose for repletion of iron using ferric carboxymaltose is determined based on the patient's body weight and haemoglobin level and must not be exceeded.⁽¹⁾ The **table below** should be used to determine the cumulative iron dose.⁽¹⁾

Hb (g/dL)	Patients with body weight	Patients with body weight
	35 kg to <70 kg	≥70 kg
<10	1,500 mg	2,000 mg
≥10	1,000 mg	1,500 mg

For overweight patients, a normal body weight/blood volume relationship should be assumed when determining the iron requirement.

For patients with an Hb value greater than or equal to 14g/dL, an initial dose of 500mg iron should be given and iron parameters should be checked prior to repeat dosing.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: Dilute with sodium chloride 0.9%. No other diluents should be used, as there is the potential for precipitation and/or interaction.⁽¹⁾ The table provided below gives the suggested dilution.

Ferinject			Iron			Maximum amount of sterile 0.9% m/V sodium chloride solution	Minimum administration time
2	to	4 mL	100	to	200 mg	50 mL	-
>4	to	10 mL	>200	to	500 mg	100 mL	6 minutes
>10	to	20 mL	>500	to	1,000 mg	250 mL	15 minutes

FLUSHING:

Flush with sodium chloride 0.9%⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Parenterally administered iron preparations can cause hypersensitivity reactions including anaphylactoid reactions, which may be potentially fatal. Therefore, facilities for cardio-pulmonary resuscitation must be available.⁽¹⁾

Caution is needed with every dose of intravenous iron that is given, even if previous administrations have been well tolerated.⁽¹⁰⁾

Patients should be closely monitored for signs of hypersensitivity during and for at least 30 minutes after every administration of an IV iron product.

IV iron products should only be administered when staff trained to evaluate and manage anaphylactic or anaphylactoid reactions - as well as resuscitation facilities - are immediately available.

EXTRAVASATION:

Extravasation of ferric carboxymaltose at the injection site may lead to brown discolouration and irritation of the skin. In case of extravasation, the administration of ferric carboxymaltose must be stopped immediately.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible diluent: Sodium chloride 0.9%.⁽¹⁾

Do not dilute or infuse with any other medicines or infusions (including glucose 5%).⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

None known

SODIUM CONTENT (mmol):

0.24mmol (5.5mg) of sodium per mL⁽¹⁾

OSMOLARITY / OSMOLALITY:

Comparable to blood⁽⁹⁾

pH:

5-7⁽⁹⁾

OTHER COMMENTS:

1. The use of ferric carboxymaltose has not been studied in children, and therefore is not recommended in children under 14 years.⁽¹⁾
2. Significant excipients: sodium hydroxide, hydrochloric acid.⁽¹⁾
3. Store in original package. Do not store above 30°C. Do not refrigerate or freeze.⁽¹⁾
4. Each vial of Ferinject® is intended for single use only.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Ferinject®, last updated 29/09/2011
2. Martindale accessed via www.medicinescomplete.com on 21/01/2013
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 21/01/2013 (no monograph)
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com on 21/01/2013
5. British National Formulary No. 64 September 2012 accessed on 21/10/2013
6. British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013](#)

8. Safety Data Sheet: Revision date 28/11/10
9. Drug company: Vifor Pharma. Date contacted: 25/03/2013
10. Intravenous iron and serious hypersensitivity reactions: new strengthened recommendations to manage and minimise risk, MHRA safety update, August 2013
<http://www.mhra.gov.uk/Safetyinformation/DrugSafetyUpdate/CON300398>

Version 4 (NHS Lothian local amendment)

Intravenous Immunoglobulin, human normal (Flebogamma DIF 50mg/mL)

Brands of normal human immunoglobulin are not interchangeable.

Record the batch number and expiry date from each bottle used in the patient's case notes or drug chart.

MEDICINE NAME:

Immunoglobulin, human normal 5%

TRADE NAME(S):

Flebogamma® DIF 50mg/mL

PRESENTATION OF MEDICINE:

Vials containing human normal immunoglobulin 50mg in 1mL (5%) solution for infusion
500mg in 10mL
2.5g in 50mL
5g in 100mL
10g in 200mL
20g in 400mL.⁽¹⁾

METHOD OF ADMINISTRATION:

IV Infusion: Give at an initial rate of 0.6-1.2mL/kg/hour for 30 minutes. If well tolerated, gradually increase the rate of administration to a maximum of 6mL/kg/hour for the remainder of the infusion. Use an infusion pump.⁽¹⁾

Flebogamma® DIF should be brought to room or body temperature before administration.⁽¹⁾

EXAMPLE CALCULATION:

Calculate the infusion rate using the following equation:

Infusion rate (mL/hour) = rate required (mL/kg/hour x patient weight (kg)

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Adverse reactions are more likely to occur in patients receiving normal immunoglobulin for the first time, following a prolonged period between treatments, or when a different brand of normal immunoglobulin is administered.
2. Adverse reactions include chills, headache, fever, vomiting, nausea, allergic reactions, arthralgia, low blood pressure and moderate low back pain. These may be related to the infusion rate. If they occur, reduce the rate or stop the infusion.
3. Anaphylactic reactions are rare but can occur even in patients who have tolerated previous treatment with normal immunoglobulin.

Monitoring:

- Monitor the patient (temperature, blood pressure, pulse, respiratory rate) before starting the infusion, throughout the infusion and for 1 hour after the first infusion or 20 minutes after subsequent infusions.
- Monitor urine output and serum creatinine levels. Patients must be well hydrated.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or infusions. It should be administered by a separate intravenous line.⁽¹⁾

SODIUM CONTENT (mmol):

Approximately 3.2mmol/L ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

335.9 - 339.7mOsm/kg ⁽⁹⁾

pH:

5.54 - 5.66 ⁽⁹⁾

OTHER COMMENTS:

1. Flebogamma DIF® should be stored below 30°C and protected from freezing.⁽¹⁾
2. The solution should be clear or slightly opalescent. Do not use solutions that are cloudy or has deposits.⁽¹⁾
3. Flebogamma® DIF contains 50mg/mL sorbitol as an excipient. Patients with rare hereditary problems of fructose intolerance should not receive Flebogamma® DIF. Babies and young children should not receive Flebogamma® DIF as hereditary fructose intolerance may not yet have been diagnosed.⁽¹⁾⁽⁵⁾

REFERENCES:

1. Summary of Product Characteristics. Grifols Ltd, last updated 16/06/2011
2. Martindale" accessed via <http://www.medicinescomplete.com> on 04/05/2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 04/05/2011
4. Trissel " Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 04/05/2011
5. British National Formulary No 61 March 2011 accessed via <http://www.bnf.org/bnf/>
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2010-11
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Grifols Ltd. Date contacted: 21/06/2011

Intravenous Immunoglobulin, human normal (Flebogamma DIF 100mg/mL)

Brands of normal human immunoglobulin are not interchangeable.

Record the batch number and expiry date from each bottle used in the patient's case notes or on the drug chart.

MEDICINE NAME:

Immunoglobulin, human normal

TRADE NAME(S):

Flebogamma® DIF 100mg/mL

PRESENTATION OF MEDICINE:

Glass bottles containing immunoglobulin 100mg in 1mL (10%) solution for infusion

5g in 50mL

10g in 100mL

20g in 200mL⁽¹⁾

METHOD OF ADMINISTRATION:

IV Infusion: Give by intravenous infusion at an initial rate of 0.6mL/kg/hour for the first 30 minutes. If well tolerated, increase the rate of administration to 1.2mL/kg/hour for the second 30 minutes. Again, if tolerated, increase the rate of administration further to 2.4mL/kg/hour for the third 30 minutes. If the patient tolerates the infusion well, additional increments of 1.2mL/kg/hour may be made at 30-minute intervals up to a maximum of 4.8mL/kg/hour. Use an infusion pump.⁽¹⁾⁽⁹⁾

Flebogamma® DIF should be brought to room or body temperature before administration.⁽¹⁾

EXAMPLE CALCULATION:

Calculate the infusion rate using the following equation:

Infusion rate (mL/hour) = rate required (mL/kg/hour) x patient weight (kg)

FLUSHING:

Sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Adverse reactions are more likely to occur in patients receiving normal immunoglobulin for the first time, following a prolonged period between treatments, or when a different brand of normal immunoglobulin is administered.
2. Adverse reactions include chills, headache, fever, vomiting, nausea, allergic reactions, arthralgia, low blood pressure and moderate low back pain. These may be related to the infusion rate. If they occur, reduce the rate or stop the infusion.
3. Anaphylactic reactions are rare but can occur even in patients who have tolerated previous treatment with normal immunoglobulin.

Monitoring:

- Monitor the patient (temperature, blood pressure, pulse, respiratory rate) before starting the infusion, throughout the infusion and for 1 hour after the first infusion or 20 minutes after subsequent infusions.
- Monitor urine output and serum creatinine levels. Patients must be well hydrated.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines.⁽¹⁾

SODIUM CONTENT (mmol):

Approximately 3.2mmol/L ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

344.8 - 350.8mOsm/kg ⁽⁹⁾

pH:

5.4 - 5.6 ⁽⁹⁾

OTHER COMMENTS:

1. Flebogamma DIF® should be stored below 30°C and protected from freezing.⁽¹⁾
2. The solution should be clear or slightly opalescent. Do not use solutions that are cloudy or have deposits.⁽¹⁾
3. Flebogamma® DIF contains 50mg/mL sorbitol as an excipient. Patients with rare hereditary problems of fructose intolerance should not receive Flebogamma® DIF. Babies and young children should not receive Flebogamma® as hereditary fructose intolerance may not yet have been diagnosed.⁽¹⁾⁽⁵⁾

REFERENCES:

1. Summary of Product Characteristics. Grifols Ltd, last updated 06/06/2011
2. Martindale" accessed via <http://www.medicinescomplete.com> on 08/08/2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 08/08/2011
4. Trissel " Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 08/08/2011
5. British National Formulary No 61 March 2011 accessed via <http://www.bnf.org/bnf/>
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2010-11
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Grifols Ltd. Date contacted: 21/06/2011

Intravenous

Flecainide acetate

MEDICINE NAME:

Flecainide acetate

TRADE NAME(S):

Tambocor ®

PRESENTATION OF MEDICINE:

Flecainide acetate, ampoules containing 150mg in 15mL.⁽¹⁾⁽⁵⁾

METHOD OF ADMINISTRATION:

Adults and children 12 years and older:

Slow IV injection: Over at least 10-30 minutes⁽¹⁾⁽⁵⁾ at a dose of 2mg/kg to maximum 150mg.^{(1)(2)(5)(6a)}

Continuous infusion if required:

Initiate treatment with a slow IV injection of 2mg/kg over 30 minutes as above, then administer infusion as follows:-^{(1)(2)(5)(6a)}

First hour: 1.5mg/kg/hour^{(1)(2)(5)(6a)}

Second and later hours: 100-250micrograms/kg/hour until arrhythmia controlled.^{(1)(2)(5)(6a)}

Maximum cumulative dose 600mg/24 hours.^{(1)(2)(5)(6a)}

Do not use IV route for longer than 24 hours.^{(1)(2)(4)(5)(6a)}

Child 1 month to 12 years (unlicensed)

Slow IV injection: 2mg/kg over 10-30 minutes.^(6a)

Continuous infusion if required:

Initiate treatment with a slow IV injection of 2mg/kg over 10-30 minutes as above.

Then: 100-250micrograms/kg/hour until arrhythmia controlled (maximum cumulative dose 600mg in 24 hours).^(6a)

Neonate (unlicensed)

Slow IV injection: 1-2mg/kg over 10-30 minutes.^(6a)

Continuous infusion if required:

Initiate with slow IV injection of 1-2mg/kg over 10-30 minutes as above.^(6a)

Then: 100-250micrograms/kg/hour until arrhythmia controlled.^(6a)

N.B. In patients with sustained ventricular tachycardia or a history of cardiac failure, it is recommended that the initial dose is given over 30 minutes.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Glucose 5% is the preferred diluent.⁽¹⁾⁽⁴⁾ May be diluted in 20mL to 500mL of glucose 5% and given as an infusion.⁽⁴⁾

If sodium chloride 0.9% is used as a diluent, do not add more than 150mg flecainide per 500mL of infusion fluid, otherwise a precipitate may form.⁽¹⁾⁽⁴⁾

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Expiry is 24 hours from the time of infusion preparation.

EXAMPLE CALCULATION:

Note: To obtain a flecainide 1mg in 1mL solution remove 50mL of fluid from a 500mL bag of glucose 5% and replace with 500mg (50mL of flecainide)

Table 1 Flecainide infusion rate for first hour at 1.5mg/kg/hour using a 1mg in 1mL solution		
Weight (kg)	Dose (1.5mg/kg)	Rate(mL per hour)
40	60	60
50	75	75
60	90	90
70	105	105
80	120	120
90	135	135
100	150	150

Table 2 Flecainide infusion rates in mL/hour for the second and subsequent hours using a 1mg in 1mL solution				
Weight (kg)	Dose in micrograms/kg/hour			
	100	150	200	250
40	4	6	8	10
50	5	7.5	10	12.5
60	6	9	12	15
70	7	10.5	14	17.5
80	8	12	16	20
90	9	13.5	18	22.5
100	10	15	20	25

FLUSHING:

Glucose 5% ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Arrhythmias; continuous ECG monitoring required for IV bolus doses.^{(1)(6a)}

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Flecainide 10mg in 5mL is Y-site compatible with heparin sodium 50units/mL/minute.⁽⁴⁾

Incompatible: Flecainide 10mg in 5mL is incompatible in a syringe with heparin sodium 2500units per 1mL.⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

Not available⁽⁹⁾

SODIUM CONTENT (mmol):

1.6mmol of sodium per vial⁽¹⁰⁾

OSMOLARITY / OSMOLALITY:

Not available⁽⁹⁾

pH:

6.0 to 6.5⁽¹⁰⁾

OTHER COMMENTS:

1. Flecainide injection is clear and colourless.⁽⁴⁾
2. Continuous ECG monitoring is recommended in all patients receiving the IV injection dose.⁽¹⁰⁾
3. If chloride containing solutions are used for dilution, minimum volume of 500mL should be used or precipitate may form.⁽¹⁾⁽⁴⁾
4. Do not freeze, protect from light (during storage only).⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics. Tambocor® 10mg/mL injection, Meda Pharmaceuticals. Last revised 01/04/2010
2. Martindale. Accessed via www.medicinescomplete.com/mc/ on 09/04/2010
3. American Hospital Formulary Service Drug Information. Accessed via www.medicinescomplete.com/mc/ on 09/04/2010
4. Trissel "Handbook on injectable drugs" 15th Edition 2009, pg 698
5. British National Formulary No. 60 September 2010. Accessed via www.bnf.org/bnf on 09/04/2010
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003 pg 249
 - a) British National Formulary for Children 2010-11 accessed via <http://bnfc.org/bnfc> on 09/04/2010
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)

8. COSHH report compiled by manufacturer
9. Drug company name: Meda Pharmaceuticals
Date contacted: 05/08/2010
10. Injectable Medicines Administration Guide, 3rd Edition, UCH Hospitals, 2010

Version 3 (NHS Lothian local amendment)

Intravenous

Flucloxacillin

Contains a **PENICILLIN**.

Important: some information in this monograph is brand specific. Ensure you refer to the correct information for the brand used in your Trust.

MEDICINE NAME:

Flucloxacillin

TRADE NAME(S):

Flucloxacillin (Wockhardt UK Ltd, Bowmed Ibisqus Ltd, Genus Pharmaceuticals Ltd)

PRESENTATION OF MEDICINE:

Vials containing flucloxacillin 250mg (as sodium) powder for reconstitution.^{(1a-c)(5)}

Vials containing flucloxacillin 500mg (as sodium) powder for reconstitution.^{(1a-c)(5)}

Vials containing flucloxacillin 1g (as sodium) powder for reconstitution.^{(1a-c)(5)}

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3-4 minutes.^(1a-c)

IV Infusion: No information available from manufacturers.^(1a-c) However, the BNF suggests giving over 30-60 minutes.⁽⁵⁾

“Penicillins are not usually given by continuous infusion because of stability problems and because adequate plasma and tissue concentrations are best obtained by intermittent infusion. Where it is necessary to administer them by continuous infusion, detailed literature should be consulted.”⁽⁵⁾

INSTRUCTIONS FOR RECONSTITUTION:

Dissolve 250-500mg in 5-10mL water for injections or 1g in 15-20mL water for injections.^(1a-c)

DISPLACEMENT VALUE:

Wockhardt Ltd: 0.2mL for 250mg, 0.4mL for 500mg, 0.7mL for 1g.^(9a)

Genus Pharmaceuticals: 0.2mL for 500mg, 0.4mL for 1g.^(9b)

Bowmed Ibisqus Ltd: approximately 0.2mL for 250mg, approximately 0.35mL for 500mg, approximately 0.6mL for 1g.^(9c)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: Dilute with sodium chloride 0.9% or glucose 5%.^{(1a-c)(5)}

A recommended infusion volume is not available from the manufacturers.^(1a-c)

However, for flucloxacillin (as sodium salt), the BNF suggests an infusion volume of 100mL.⁽⁵⁾

STABILITY:

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Anaphylaxis, angioedema, rash and phlebitis.^(1a-c)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible with the following diluents in addition to those listed above: Sodium chloride 0.18% and glucose 4%.^(1a-c)

The manufacturer recommends water for injections as a suitable diluent, however, it is rarely used in practice because it is likely to cause hyponatraemia.

Incompatible: Amiodarone, atropine sulphate, buprenorphine, calcium gluconate, chlorpromazine hydrochloride, ciprofloxacin, clarithromycin, diazepam, dobutamine, erythromycin lactobionate, gentamicin sulphate, lorazepam, metoclopramide hydrochloride, midazolam, morphine sulphate, netilmicin sulphate, ofloxacin, papaveretum, pethidine hydrochloride, prochlorperazine edisylate, promethazine hydrochloride, tobramycin and verapamil hydrochloride.^(1a)

Blood products, proteinaceous fluids (eg. protein hydrolysates), lipid emulsions.^(1a-c)

If flucloxacillin is prescribed concurrently with an aminoglycoside, the two antibiotics should not be mixed in the syringe, intravenous fluid container or giving set as precipitation may occur.^(1a-c)

SODIUM CONTENT (mmol):

Negligible amount per 250mg vial; 1.11-1.13mmol in 500mg vial; 2.22-2.26mmol in 1g vial.^{(1a)(1c)(9b)} See link for further information.

OSMOLARITY / OSMOLALITY:

500mg in 10mL water for injections is 180mOsmol.^(9b)

1g in 15mL water for injections is 240mOsmol.^(9b)

2g in 20mL water for injections is 286mOsmol.^(9b)

No information.^{(9a)(9c)}

pH:

A 10% solution of flucloxacillin sodium in water has a pH 5 to 7.⁽²⁾

OTHER COMMENTS:

1. Do not store above 25°C (before reconstitution).^(1a-c)
2. Unopened flucloxacillin vials should be protected from light.^(9b)

REFERENCES:

1. Summary of Product Characteristics a) Flucloxacillin, Wockhardt UK Ltd, last revised June 2009
b) Flucloxacillin, Genus Pharmaceuticals, 500mg and 1g strengths, last revised 13/05/2010. 250mg strength last revised 11/05/2010
c) Flucloxacillin, MAH: Bowmed Ltd (distributed by Bowmed Ibisqus Ltd), all strengths last revised 12/04/2010
2. Martindale accessed via <http://www.medicinescomplete.com> on 01/03/2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 01/03/2011
4. Trissel "Handbook on injectable drugs" accessed via

- <http://www.medicinescomplete.com> on 01/03/2011
5. British National Formulary No. 61, March 2011, accessed via <http://www.bnf.org/bnf/> on 01/03/2011
 6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2010-11 accessed via <http://www.bnfc.org/bnfc> on 01/03/2011
 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
 8. COSHH report compiled by manufacturer - not available
 9.
 - a) Drug company name: Wockhardt. Date contacted: 02/03/2011
 - b) Drug company name: Genus Pharmaceuticals. Date contacted: 02/03/2011
 - c) Drug company name: Bowmed Ibisqus Ltd. Date contacted: 02/03/2011

Version 3 (NHS Lothian local amendment)

Intravenous

Fluconazole

MEDICINE NAME:

Fluconazole

TRADE NAME(S):

Diflucan®
Generic (Hospira UK Ltd)
Generic (Pliva Pharma Ltd)

PRESENTATION OF MEDICINE:

Vials containing fluconazole 200mg in 100mL solution for infusion. ^{(1a)(1c)}
Vials containing fluconazole 50mg in 25mL solution for infusion. ^{(1a)(1c)}
Bags containing fluconazole 400mg in 200mL solution for infusion. ^(1b)
Bags containing fluconazole 200mg in 100mL solution for infusion. ^(1b)
Bags containing fluconazole 100mg in 50mL solution for infusion. ^(1b)

METHOD OF ADMINISTRATION:

IV infusion: Adults: Administer at a rate of 5-10mL per minute (i.e. 10-20mg per minute) ^{(1a)(1b)(1c)(2)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Further dilution is unnecessary ^{(1a)(1b)(1c)}

STABILITY

For single use only, discard any remaining solution. ^(1a)

FLUSHING:

Flush with sodium chloride 0.9%. ⁽¹⁰⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Anaphylaxis (including angiodema, face odema, pruritis) ^{(1a)(1b)(1c)} and urticaria. ^(1a)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Compound sodium lactate (Hartmanns solution), ^{(1a)(1c)} sodium bicarbonate 4.2%, ^{(1a)(1c)} potassium chloride in glucose, ^{(1a)(1c)(10)} Ringer's solution, ^{(1a)(1c)} sodium chloride 0.9%, ^{(1a)(1c)(10)} aciclovir, ⁽⁴⁾⁽¹⁰⁾ amikacin, ⁽⁴⁾ aminophylline, ⁽⁴⁾ amiodarone, ⁽⁴⁾ ciprofloxacin, ⁽⁴⁾ dobutamine, ⁽⁴⁾ dopamine, ⁽⁴⁾ dexamethasone, ⁽⁴⁾⁽¹⁰⁾ drotrecogin alpha, ⁽⁴⁾ folinic acid, ⁽⁴⁾⁽¹⁰⁾ foscarnet, ⁽⁴⁾⁽¹⁰⁾ gentamicin, ⁽⁴⁾ ganciclovir, ⁽⁴⁾⁽¹⁰⁾ glucose 20%, ^{(1a)(1c)} heparin, ⁽⁴⁾⁽¹⁰⁾ linezolid, ⁽⁴⁾ metoclopramide, ⁽⁴⁾ meropenem, ⁽⁴⁾ midazolam, ⁽⁴⁾ morphine sulphate, ⁽⁴⁾ metronidazole, ⁽⁴⁾⁽¹⁰⁾ phenytoin, ⁽⁴⁾ vancomycin ⁽⁴⁾⁽¹⁰⁾

Incompatible: N.B. No additions should be made to fluconazole infusion. ^{(1a)(10)}

The following should not be infused concurrently with fluconazole:-

Amphotericin, ⁽⁴⁾⁽¹⁰⁾ calcium gluconate, ⁽⁴⁾⁽¹⁰⁾ cefuroxime, ⁽⁴⁾⁽¹⁰⁾ cefotaxime, ⁽⁴⁾ ceftazidime, ⁽⁴⁾⁽¹⁰⁾ ceftriaxone, ⁽⁴⁾ chloramphenicol, ⁽⁴⁾ clindamycin, ⁽⁴⁾ diazepam, ⁽⁴⁾ digoxin, ⁽⁴⁾ erythromycin, ⁽¹⁰⁾ furosemide, ⁽⁴⁾⁽¹⁰⁾ imipenem, ⁽⁴⁾⁽¹⁰⁾ pentamidine, ⁽⁴⁾ trimethoprim-sulfamethoxazole ⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

None required ^{(1a)(1b)(1c)}

SODIUM CONTENT (mmol):

3.75mmol sodium per 50mg (25mL) vial. ^(1a)

7.5mmol sodium per 100mg (50mL) bag. ^(1b)

15mmol sodium per 200mg (100mL) bag/vial. ^{(1a)(1b)}

30mmol sodium per 400mg (200mL) bag. ^(1b)

OSMOLARITY / OSMOLALITY:

The infusion solution is iso-osmotic having an osmolality of 300 to 315mOsmol/L ⁽³⁾⁽⁹⁾⁽¹¹⁾

pH:

pH 4 to 8 ⁽³⁾⁽¹⁰⁾⁽¹¹⁾

OTHER COMMENTS:

1. Preservative free therefore infusions are for single use only. ^{(1a)(1b)(1c)}
2. Store below 30°C for the Pfizer product ^(1a) and not above 25°C for the Hospira product. ^(1b) No limits given for the Pliva product. ^(1c)

REFERENCES:

1. a) Summary of Product Characteristics (Diflucan®) last updated April 2007
b) Summary of Product Characteristics (fluconazole - Hospira) last updated 13/12/2007
c) Summary of Product Characteristics (fluconazole - Pliva) last updated May 2004
2. Martindale accessed via <http://medicinescomplete.com> on 06/05/2008
3. American Hospital Formulary Service Drug Information 2007
4. Trissel "Handbook on injectable drugs" 13th Edition pg 722
5. British National Formulary No. 55 pg 328
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2008 pg 363
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#) pg 53
8. COSHH report compiled by manufacturer - reports not available from either manufacturer
9. Drug company name: Pfizer Ltd
Date contacted: 27/05/2008
10. UCL Hospitals Injectable Drug Administration Guide 2004
11. Accessibilitybybard.co.uk accessed 21/05/2008

Version 2 (NHS Lothian local amendment)

Intravenous

Flucytosine

MEDICINE NAME:

Flucytosine

TRADE NAME(S):

Ancotil®

PRESENTATION OF MEDICINE:

Infusion bottle containing 2.5g flucytosine in 250mL isotonic sodium chloride solution ⁽¹⁾

METHOD OF ADMINISTRATION:

ADULTS AND CHILDREN:

IV infusion: Infuse over 20-40 minutes. The duration should be balanced with the fluid requirements of the patient. ⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Provided ready diluted. ⁽¹⁾

EXAMPLE CALCULATION:

Dose of flucytosine in adults and children is 200mg/kg body weight divided into four doses over 24 hours, i.e., 50mg/kg four times a day, infused over 20-40 minutes.

For example the dose of flucytosine for a 70kg patient would be 3500mg or 350mL of a 2.5g in 250mL solution, four times a day, infused over 20-40 minutes.

The following table shows the doses and volumes required for different patient weights using flucytosine 2.5g in 250mL solution.

Dose : 50mg/kg four times day		
Patient's body weight	Flucytosine dose	Flucytosine volume (mL) to be infused over 20 -
50 kg	2500mg	250mL
60 kg	3000mg	300mL
70 kg	3500mg	350mL
80 kg	4000mg	400mL

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Allergic reactions and CNS disturbances may infrequently occur. Local irritation or phlebitis does not appear to be a problem with flucytosine 2.5g in 250mL. ⁽¹⁾

EXTRAVASATION:

Flucytosine 2.5g in 250mL is not an irritant or a vesicant.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible with the following infusions (it is assumed that the infusions mix in the administration set close to the cannula insertion site): Sodium chloride 0.9%, glucose 5% and glucose 4% with sodium chloride 0.18%.

No other medicine or infusion fluid should be added to or mixed with flucytosine.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

No special handling precautions recommended by the manufacturer.⁽⁸⁾

Handle with care and minimum exposure: teratogenic in rats (as flucytosine is metabolised to fluorouracil in this species), potentially teratogenic in humans.⁽¹⁾

SODIUM CONTENT (mmol):

34.5mmol per 250mL bottle.⁽⁵⁾

OSMOLARITY / OSMOLALITY:

290-320mOsm/Kg.⁽⁹⁾

pH:

pH = 7 to 7.8;⁽⁹⁾ 7.4⁽¹⁰⁾

OTHER COMMENTS:

1. Store flucytosine 2.5g in 250mL between 18°C and 25°C.⁽¹⁾
2. Precipitation of flucytosine may occur if stored below 18°C while prolonged storage above 25°C could result in the formation of 5-fluorouracil.⁽¹⁾⁽²⁾

REFERENCES:

1. Summary of Product Characteristics, Ancotil 2.5g/250mL Solution for Infusion, last revised December 2010
2. Martindale accessed via <http://www.medicinescomplete.com> on 06/11/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 06/11/2012
4. Trissel "Handbook on injectable drugs" 15th Edition
5. British National Formulary No. 64, September 2012 accessed via www.bnf.org on 06/11/2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2012-2013 accessed via www.bnfc.org on 06/11/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer, expiry 12/03/2012

9. Drug company name: Meda Pharmaceuticals
Date contacted: 06/11/2012
10. www.extravasation.org.uk accessed on 22/11/2012

Version 5 (NHS Lothian local amendment)

Intravenous

MEDICINE NAME:

Flumazenil

Flumazenil

TRADE NAME(S):

Anexate®
Flumazenil (Bowmed Ibisqus Ltd, hameln Pharmaceuticals, Teva
UK, Hikma)

PRESENTATION OF MEDICINE:

Ampoules containing flumazenil 500micrograms in 5mL. Solution for injection or infusion.^(1a-d)

Ampoules containing flumazenil 1mg in 10mL. Solution for injection or infusion.^(1b-d)

METHOD OF ADMINISTRATION:

IV injection:

For adults and children: give as a rapid IV injection over 15-30 seconds. Further doses may be given at 60 second intervals if required.^(1a-d)

IV infusion: Give at a rate of 100 to 400micrograms per hour (adults) and 2 to 10micrograms/kg/hour (infants and children [unlicensed], maximum 400micrograms per hour in those aged 1 month and over), adjusted according to response.^{(1a-d)(6a)} Stop infusion every 6 hours to check whether re-sedation occurs.^{(1c)(1d)}

Due to the extreme pH of this preparation, to avoid possible venous irritation, it may be advisable to administer via a central venous access device.⁽¹³⁾ If this is not possible, use a freely running established IV infusion line into a large peripheral vein.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV injection: Administer undiluted.

IV infusion: Flumazenil solution must be diluted to a suitable concentration prior to infusion.^{(1c)(1d)} Dilute with sodium chloride 0.9% or glucose 5%.^(1a-d) Suitable concentrations are 2 to 10micrograms per mL.^(1c)

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

24 hours ^(1a-d)

FLUSHING:

Sodium chloride 0.9%, glucose 5% ^(1a-d)

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Pain on injection.^{(1c)(1d)} This can be minimised by administering flumazenil through a freely running established IV infusion line into a central/large peripheral vein.⁽³⁾⁽⁴⁾

Transient increases in blood pressure, heart rate, flushing and allergic reactions (including anaphylaxis).^{(1a-d)(2)}

Excessive (more than 1mg) and/or rapidly injected doses may induce anxiety, fear, agitation, dizziness, sweating, tachycardia and palpitations. This is more likely in patients

on long-term and/or high dose benzodiazepines.^(1a-d) A slower rate of administration should be considered for these patients.⁽²⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage because of a low pH and a risk of local irritation.⁽³⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Flumazenil is compatible with the following diluents in addition to those listed above:

Sodium chloride 0.45% and glucose 2.5% IV infusion^(1c)

Incompatible:

IV injection: Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.^(1a-d)

IV infusion: Do not infuse with any other medicines.^(1a-d)

SODIUM CONTENT (mmol):

500micrograms in 5mL ampoule contains 0.7 - 2.2mmol sodium.^(1a-d)

1mg in 10mL ampoule contains 1.5 - 4.04mmol sodium.^{(1c)(1d)(10)}

OSMOLARITY / OSMOLALITY:

Osmolality 270 - 300mOsm/kg ⁽⁹⁾⁽¹⁰⁾

pH:

3.5 to 4.5 ^{(1d)(10)}

OTHER COMMENTS:

1. Store below 25-30°C.^{(1b)(1c)}
2. Do not refrigerate or freeze.^(1d)
3. Protect ampoules from light.^(1d)

REFERENCES:

1. Summary of Product Characteristics
 - a) Anexate®, Roche, last updated November 2010
 - b) Flumazenil Injection, MAH: Bowmed Ltld (distributed by Bowmed Ibisqus Ltd), last updated 29/07/2011
 - c) Flumazenil injection, hameln, last updated October 2007
 - d) Flumazenil injection, Teva UK, last updated March 2009
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 25/05/2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 25/05/2011
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 25/05/2011
5. British National Formulary No. 61, March 2011 pg 792, accessed via www.bnf.org
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2010-11 pg 796 via www.bnfc.org
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov](#)

[2010](#)

a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)

8. COSHH report compiled by manufacturer (Hameln). Revised December 2008
9. Drug company name: Roche. Date contacted: 06/06/2009
10. Drug company name: Bowmed Ibisqus Ltd. Date contacted: 08/05/2009
11. Drug company name: Teva. Date contacted: 27/05/2011
12. Reducing the risk of overdose with midazolam injection in adults. Rapid Response Report. NPSA/22008/RRR011
13. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 4

Intravenous

Fosfomycin

Unlicensed in the UK.

Some information in this monograph is brand specific. Ensure you refer to the correct information for the brand used in your hospital.

MEDICINE NAME:

Fosfomycin

TRADE NAME(S):

Fosfocina® (Laboratorios ERN - Spain)
Infectofos® (Infectopharm - Germany)

PRESENTATION OF MEDICINE:

Fosfocina®: Vials containing fosfomycin 1g or 4g (as sodium salt) powder for reconstitution.^(1a)

Infectofos®: Vials containing fosfomycin 2g, 3g, 5g and 8g (as sodium salt) powder for reconstitution.^(1b)

METHOD OF ADMINISTRATION:

IV Infusion:

Fosfocina®: Administer over 60 minutes.^(1a)

Infectofos®: Administer over 30 minutes.^(1b)

Do not administer by IV injection.

Administer using an infusion pump via a large vein (local practice in LHCH: administer fosfomycin via a long line or Portacath®).

Infectofos®: Preferably administer higher doses via a central venous access device (5g and over) to avoid potential venous irritation as these preparations have a high pH and/or a high osmolality.

INSTRUCTIONS FOR RECONSTITUTION:

Fosfocina®:

1g- Reconstitute with 10mL water for injections (ampoule supplied).^(1a)

4g- Reconstitute with 20mL water for injections.^(1a)

Further dilution is necessary before administration.^(1a)

Infectofos®:

Reconstitute 2g infusion bottle with 40-60mL of water for injections or glucose 5%.^(1b)

Reconstitute 3g and 5g infusion bottles with 100mL of water for injections or glucose 5%.^(1b)

Reconstitute 8g infusion bottle with 200mL of water for injections or glucose 5%.^(1b)

The solution may get warm during reconstitution.^{(1a)(1b)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Fosfocina®: water for injections^(1a) or glucose 5%^(9a)

1g vial- After reconstitution further dilute to 50mL

4g vial- After reconstitution further dilute to 200mL

Infectofos®: see instructions for reconstitution above.

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

Infusion expiry: The solution diluted for infusion in glucose 5% is stable for 24 hours at room temperature.^(1a)

FLUSHING:

Sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypersensitivity reactions (urticaria, pruritus, angioedema, phlebitis, anaphylaxis (rarely)).^{(1a)(1b)}

Monitor electrolytes, can cause electrolyte disturbance (see sodium content).^{(1a)(1b)}

EXTRAVASATION:

Extravasation is likely to cause tissue damage with higher doses of fosfomycin (5g and over) as these preparations have a high osmolality.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Fosfocina®

No information

Incompatible: ampicillin, erythromycin lactobionate, gentamicin oxytetracycline, rifampicin.^(1a)

Infectofos®

Compatibility with solutions other than the recommended diluents (water for injections or glucose 5%) is not guaranteed.^(1b)

SPECIAL HANDLING PRECAUTIONS:

Wash with soap and water if product comes into contact with skin.

If fosfomycin comes into contact with eyes: irrigate thoroughly with water. Obtain medical attention if irritation persists.^{(8a)(8b)}

SODIUM CONTENT (mmol):

Fosfocina®: 14.35mmol per 1g vial, 57.4mmol per 4g vial.^(1a)

Infectofos®: 29mmol per 2g vial, 43.5mmol per 3g vial; 72.5mmol per 5g vial; 116mmol per 8g vial.^(1b)

OSMOLARITY / OSMOLALITY:

Fosfocina®: No data available from manufacturer.^(9a)

Infectofos®: 3g vial 511.8mOsmol/L (in 100mL water for injections), 5g vial 880mOsmol/L (in 100mL of water for injections).^(9b) Preferably administer this preparation via a central venous access device to avoid potential venous irritation as it has a high osmolality.

pH:

Fosfocina®: No data on infusion preparation.^{(1a)(9a)}

Infectofos®: pH value of the reconstituted solution between 6-8.^(9b)

REFERENCES:

1. Summary of Product Characteristics
 - a) Fosfocina® accessed via www.ern.es/eng/hospitalaria/fosfocina/html on 15/01/2012
 - b) Infectofos® last revised June 2009
2. Martindale accessed via <http://medicinescomplete.com> on 13/01/2012
3. American Hospital Formulary Service Drug Information" accessed via <http://medicinescomplete.com> on 13/01/2012
4. Trissel "Handbook on injectable drugs" accessed via <http://medicinescomplete.com> on 13/01/2012
5. British National Formulary No. 62, September 2011 accessed via www.bnf.org.uk on 13/01/2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012 accessed via www.bnf.org.uk/bnfc on 15/01/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
 - a) Fosfocina®, May 2011
 - b) Infectofos®, May 2011
9. a) Drug company name: Laboratorios ERN, S.A. Date contacted: December 2010 - June 2011
b) Drug company name: Infectopharm. Date contacted: June 2011

Version 1 (NHS Lothian local amendment)

Intravenous

MEDICINE NAME:

Furosemide
(frusemide)

Furosemide

TRADE NAME(S):

Lasix®^(1a)
Furosemide Injection BP Minijet (UCB)^(1b)
Furosemide injection 10mg/mL Wockhardt,^(1c) Hameln,^(1d)
Goldshield/Antigen,^(1e)
Martindale Pharma, Cardinal Health,^(1f) Ranbaxy,^(1g) Claris
Lifesciences UK^(1h)

PRESENTATION OF MEDICINE:

Ampoules containing furosemide 20mg in 2mL^{(1a)(1c-h)}
Ampoules containing furosemide 50mg in 5mL^{(1d-f)(1h)}
Ampoules containing furosemide 250mg in 25mL^{(1d)(1e)}
Vials for Minijet Injector containing furosemide 80mg in 8mL^(1b)
Vials containing furosemide 250mg in 25mL^(1c)

METHOD OF ADMINISTRATION:

ADULTS:

IV Injection: Give slowly. **A rate of 4mg per minute should not be exceeded.**^{(1a-h)(2)}

N.B. The BNF states that a rate of 4mg per minute should not usually be exceeded however a **single dose** of up to 80mg may be administered more rapidly;⁽³⁾⁽⁵⁾ a lower infusion rate may be necessary in those with renal impairment.^{(1e)(5)}

Rate should not exceed 2.5mg per minute in patients with severe renal impairment i.e. serum creatinine greater than 5mg/dL (442micromoles in 1Litre)^{(1a)(1c-d)(1g-h)}

IV Infusion: Give doses above 50mg by slow intravenous infusion only⁽⁵⁾ at a rate not exceeding 4mg per minute.^{(1a)(1c-e)(1g)(2)(4)(5)}

Rate should not exceed 2.5mg per minute in patients with severe renal impairment i.e. serum creatinine greater than 5mg/dL (442micromoles in 1L).^{(1a)(1c-d)(1g-h)}

CHILDREN:

IV Injection:

Give over 5-10 minutes at usual rate of 100micrograms/kg/minute (not exceeding 500micrograms/kg/minute).^(6a) A maximum rate of 4mg per minute must not be exceeded.

IV Infusion: 100micrograms/kg/hour to 2mg/kg/hour.^{(6)(6a)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Furosemide injection may be administered slowly undiluted.^{(1a-h)(10)} For infusion the volume used is not critical and is dependent on the patient's state of hydration.⁽²⁾

ADULTS:

IV injection: Can be diluted if necessary with sodium chloride 0.9% to aid slow administration.

IV infusion: For infusion may dilute to 1mg in 1mL with sodium chloride 0.9%.^{(1b)(1e)(1h)(2)}

CHILDREN:

IV injection and IV infusion: May dilute with sodium chloride 0.9% to a concentration of 1-2mg in 1mL.^(6a)

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

24 hours.⁽⁴⁾

EXAMPLE CALCULATION:

IV infusion (ADULTS):

Divide the furosemide dose (mg) by the rate (mg per minute) to calculate the minimum number of minutes over which the infusion should be given.

The rate of the infusion (in mL per hour) is the volume of the infusion (mL) divided by the minimum number of minutes it must be given over multiplied by 60.

Example 1

To give 100mg furosemide in 50mL sodium chloride 0.9% at a rate no faster than 4mg per minute.

100mg must be given over a minimum of $100/4$ minutes = 25 minutes. Give 50mL over minimum 25 minutes.

The infusion rate per hour is $50/25 \times 60 = 120$ mL per hour

Example 2

Add 250mg furosemide in 25mL to 250mL sodium chloride 0.9% to make 250mg furosemide in about 275mL (Note the volume will be higher because of the overage in the bag). For an infusion rate of 4mg furosemide per minute:

Give 250mg over a minimum of $250/4$ minutes = 62.5 minutes

The rate per hour is $275/62.5 \times 60 = 264$ mL per hour

In severe renal failure: To give furosemide at a rate of 2.5mg per minute: 250mg/275mL is given over a minimum of $250/2.5 = 100$ minutes. Rate = $275/100 \times 60 = 165$ mL per hour.

IV Infusion (CHILD):

Examples: To make 1mg in 1mL prepare 40mg furosemide in 40mL sodium chloride 0.9%. Infusion rate of 100micrograms/kg/hour = 0.1mL/kg/hour.

In fluid restriction prepare furosemide 2mg in 1mL sodium chloride 0.9%. Prepare 80mg furosemide in 40mL so 0.1mL/kg/hour = 200micrograms/kg/hour.

FLUSHING:

Flush with sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Hypersensitivity reactions, purpuric and urticarial rashes - discontinue furosemide immediately. ^(1a-h)
2. Fluid and electrolyte depletion may occur causing headache, dizziness, confusion, weakness, hypotension, dehydration, circulatory collapse, haemoconcentration and thrombosis, cardiac arrhythmias, cramps ^{(1a-h)(2)(3)}
3. Monitor blood pressure, fluid balance and electrolytes. ^{(1a-h)(2)(3)}
4. Rapid administration and high doses may cause tinnitus and deafness. ^{(1a-h)(2)(3)(5)(6a)}
5. Acute urinary retention may occur- ensure urinary output is secured ^{(1a-h)(2)(5)}
6. May cause thrombophlebitis. ^{(1b)(3)}
7. Hypokalaemia may precipitate encephalopathy and coma in patients with hepatic impairment. ⁽⁵⁾

EXTRAVASATION:

Extravasation may cause tissue damage due to high pH.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not mix with any other drugs in the injection container ^{(1a)(1c-h)}

When giving by IV injection do not administer via an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

Compatible (it is assumed that medicines meet close to the vascular access device) Furosemide diluted to 1mg in 1mL in sodium chloride 0.9% has been found compatible with the following injections in sodium chloride 0.9%: Aminophylline 1g in 1L, ampicillin sodium 2g in 100mL, calcium gluconate 2g in 1L, dexamethasone sodium phosphate 4mg in 1mL, digoxin 250micrograms in 10mL, heparin sodium 20units in 1mL, hydrocortisone sodium succinate 50mg in 1mL, lidocaine 200mg in 100mL, meropenem 1g in 50mL, ranitidine 50mg in 100mL. ⁽⁴⁾

Furosemide 10mg in 1mL (i.e. undiluted) with second drug undiluted or diluted in sodium chloride 0.9% was found compatible with: fentanyl citrate 50microgram in 1mL, heparin sodium 1000units in 1mL, meropenem 50mg in 1mL, potassium chloride 40mmol in 1L, tirofiban 50microgram in 1mL. ⁽⁴⁾

Incompatible: Solutions of furosemide for injection are alkaline and should not be mixed or diluted with glucose injection or other (highly ^{(1b)(1h)}) acidic solutions ⁽²⁾ or infusion solutions with a pH below 5.5. ^{(1h)(3)(4)(5)(6a)} If the solution pH is below 5.5 pH adjustment has been recommended. ⁽³⁾⁽⁴⁾ Furosemide is soluble in alkaline solutions ^{(1b)(4)} and may precipitate out of solutions of low pH. ^{(1a)(1c)(1e)(1g)(3)} Glucose solutions are not suitable infusion fluids. ^{(1c-g)(5)(6a)}

However furosemide 10mg in 1mL injection mixed with an equal volume of potassium chloride 40mmol/L in each of glucose 5% injection, Lactated Ringer's injection and sodium chloride 0.9% injection was found to be physically compatible for 4 hours. ⁽⁴⁾⁽¹³⁾

Furosemide injection has been reported to be incompatible with adrenaline, ^{(1d)(1h)(3)(4)} amiodarone, ⁽⁴⁾ aminoglycosides, ⁽⁴⁾ antihistamines, ⁽³⁾ ascorbic acid, ⁽³⁾ buprenorphine, ⁽⁴⁾ caffeine, ⁽⁴⁾ ciprofloxacin, ⁽³⁾⁽⁴⁾ cisatracurium besilate, ⁽²⁾⁽³⁾⁽⁴⁾ clarithromycin, ⁽⁴⁾ diltiazem, ⁽²⁾⁽⁴⁾ diazepam, ^{(1d)(4)} dobutamine, ^{(1d)(2)(4)} dopamine, ⁽²⁾⁽⁴⁾ doxapram, ⁽⁴⁾ doxorubicin, ^{(1d)(4)} droperidol, ^{(1d)(4)} erythromycin, ⁽⁴⁾ esmolol, ⁽⁴⁾ famotidine, ⁽⁴⁾ filgrastim, ⁽⁴⁾ fluconazole, ⁽⁴⁾ gentamicin, ^{(1d)(4)} hydralazine, ⁽⁴⁾ isoprenaline, ^{(1d)(4)} labetalol, ⁽²⁾⁽³⁾⁽⁴⁾ levofloxacin ⁽²⁾⁽⁴⁾ lidocaine, ^(1d) local anaesthetics, ⁽³⁾ mannitol, ^(1d) metoclopramide, ^{(1d)(4)} midazolam, ⁽²⁾⁽⁴⁾ milrinone, ⁽²⁾⁽³⁾⁽⁴⁾ morphine, ⁽³⁾⁽⁴⁾ nicardipine, ⁽²⁾⁽⁴⁾ noradrenaline, ^{(1h)(3)(4)} ondansetron, ⁽⁴⁾ pantoprazole, ⁽⁴⁾ parenteral nutrition solutions, ⁽²⁾ pethidine, ^{(1d)(3)(4)} phenylephrine, ⁽²⁾⁽⁴⁾ prochlorperazine, ⁽⁴⁾ promethazine, ⁽⁴⁾ tetracycline, ⁽³⁾ tobramycin, ⁽⁴⁾ vasopressin, ⁽²⁾⁽⁴⁾ vecuronium bromide, ⁽²⁾⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

No information ⁽⁸⁾

SODIUM CONTENT (mmol):

Negligible: 0.13-0.2mmol sodium per mL ^{(1c)(3)(9a-f)(9h)}

See link for further information.

OSMOLARITY / OSMOLALITY:

270-330mOsmol/kg ^(9a)

287-291mOsmol/kg ⁽⁴⁾

pH:

pH 8.0 to 9.3 ^{(2)(3)(4)(9a-h)}

See link for further information. See link.

OTHER COMMENTS:

1. Protect from light during storage. ^{(1a)(1d)(1g)(1h)(2)(3)(4)}
2. Do not use solutions with a yellow colour. ⁽³⁾⁽⁴⁾
3. Do not store above 25°C. ^{(1b)(1d-f)} Excursions between 15 and 30°C are permitted. ⁽²⁾⁽³⁾
4. Refrigeration may cause precipitation. ⁽³⁾⁽⁴⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Lasix® injection 20mg/2mL (Sanofi Aventis) revised 27 July 2010
 - b) Furosemide injection BP Minijet 10mg/mL (IMS) revised September 2009
 - c) Furosemide 10mg/mL Solution for injection of infusion (Wockhardt UK) revised 21/02/2011
 - d) Furosemide injection BP (Hameln Pharmaceuticals) revised 19/08/2008
 - e) Furosemide injection BP (Goldshield/Antigen) revised 13/06/2011
 - f) Furosemide injection 1.0% (Cardinal Health, Martindale Pharma) revised 03/11/2006
 - g) Furosemide 10mg/2mL Solution for injection (Ranbaxy) revised 08/01/2009
 - h) Furosemide 10mg/mL Solution for injection (Claris Lifesciences UK) revised 21/01/2009
2. Martindale accessed via <http://www.medicinescomplete.com> on 07/02/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 09/01/2012
4. Trissel " Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 08/02/2012
5. British National Formulary No 62 September 2011, p86-87 accessed via <http://www.bnf.org/bnf/> on 05/02/2012
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003
 - a) British National Formulary for Children 2011-12, pg 79 accessed via <http://bnfc.org/bnfc> on 05/02/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturers (not used)
Furosemide injection Safety Data Summary UCB reviewed 10/11/2005
Materials Information Sheet Furosemide Injection Hameln revised November 2005
9.
 - a) Drug company name: Sanofi-Aventis. Date contacted: 03/01/2012
 - b) Drug company name: UCB. Date contacted: 28/12/2011
 - c) Drug company name: Wockhardt. Date contacted: 03/01/2012
 - d) Drug company name: Hameln Pharmaceuticals. Date contacted: 29/12/2011
 - e) Drug company name: Goldshield. Date contacted: 09/01/2012

- f) Drug company name: Cardinal Health, Martindale Pharma. Date contacted: 12/2011
- g) Drug company name: Ranbaxy. Date contacted: 01/2012
- h) Drug company name: Claris Lifesciences UK Ltd. Date contacted: 01/2012
- i) Drug company name: Baxter Surecall. Date contacted: 18/01/2010
- j) Drug company name: Fresenius-Kabi. Date contacted: 18/01/2010
- 10. UKCPA Critical Care Group. Minimum Infusion Volumes for Fluid Restricted Critically Ill patients, 3rd Edition 2006 version 3.1
- 11. UK Ambulance Service Clinical Practice Guidelines (2006). Furosemide updated 23/05/2007. accessed 06/02/2012 via [Joint Royal Colleges Ambulance Liaison Committee - Guideline Development Group \(JRCALC-GDG\) stakeholder website](#)
- 12. Ho KM, Sheridan DJ. Meta-analysis of furosemide to prevent or treat acute renal failure. BMJ 2006;333:420-3
- 13. Allen LV, Jr, Stiles ML. Compatibility of various admixtures with secondary additives at Y-injection sites of intravenous administration sets. Part 2. Am J Hosp Pharm 1981;38:380-381

Version 4

Intravenous

Ganciclovir

The reconstitution and dilution of this product MUST be done in a Pharmacy Aseptic Unit. Contact Pharmacy for further information.

MEDICINE NAME:

Ganciclovir

TRADE NAME(S):

Cymevene®

PRESENTATION OF MEDICINE:

Each vial contains 543mg of ganciclovir sodium, equivalent to 500mg ganciclovir ⁽¹⁾

METHOD OF ADMINISTRATION:

IV infusion: over 1 hour, after dilution ⁽¹⁾⁽³⁾⁽⁴⁾⁽⁵⁾ into a large vein with adequate blood flow, preferable via a plastic cannula. ⁽¹⁾⁽³⁾⁽⁴⁾

Infuse ganciclovir solutions only into veins with adequate blood flow to allow rapid dilution and distribution. ⁽¹⁾⁽³⁾

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a high pH.

Not to be administered undiluted, nor by rapid IV injection. ⁽¹⁾⁽³⁾⁽⁴⁾

Rapid or bolus intravenous injection must be avoided as the toxicity of ganciclovir may be increased as a result of excessive plasma levels. ⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Inject 10mL sterile preservative free water for injections into 1 vial ⁽¹⁾⁽³⁾⁽⁴⁾ to give a concentration of ganciclovir 50mg in 1mL. ⁽¹⁾⁽⁵⁾ The vial should be shaken to dissolve the drug and inspected for particulate matter before further dilution. ⁽¹⁾⁽³⁾

DISPLACEMENT VALUE:

Displacement value is 0.31mL per 500mg vial ⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Dilute with compatible infusion fluid e.g. sodium chloride 0.9% or glucose 5%, to a concentration **not exceeding 10mg/mL**. 100mL is usually used. ⁽¹⁾⁽³⁾

Use of more concentrated solutions is not recommended. ⁽¹⁾⁽³⁾⁽⁴⁾

Failure to further dilute the reconstituted solution or if administered as an IV bolus, may lead to crystalluria and renal tubular damage and increase the risk of bone marrow damage. ⁽¹⁰⁾

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

As per Pharmacy Aseptic labelling.

FLUSHING:

Sodium chloride 0.9% ⁽¹⁾⁽³⁾⁽⁴⁾⁽⁵⁾ or glucose 5%. ⁽⁵⁾⁽¹⁰⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Dyspnoea is a very common adverse reaction, which is reported in one in every ten patients treated with ganciclovir.⁽¹⁾ Common adverse reactions include injection site pain and chest pain.⁽¹⁾

Uncommon adverse reactions reported include anaphylactic reactions, arrhythmias and hypotension.⁽¹⁾

EXTRAVASATION:

May cause tissue damage due to extreme pH.⁽³⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

No information

Incompatible: Manufacturer recommends ganciclovir should not be mixed with any other intravenous products.⁽¹⁾

The dry powder should not be reconstituted with bacteriostatic water containing parabens (para-hydroxybenzoates), since these are incompatible with ganciclovir sterile powder and may cause precipitation.⁽¹⁾

Other suitable diluents: Ringer's or lactated Ringer's solution,⁽¹⁾ or compound sodium lactate⁽⁶⁾ to a concentration not exceeding 10mg/mL.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

Handle as for cytotoxics. Wear gloves and safety glasses when handling. The use of polyethylene or latex gloves and safety glasses is recommended to avoid exposure in case of breakage of the vial. If the solution contacts skin or mucosa, immediately wash thoroughly with soap and water. Rinse eyes for at least 15 minutes with sterile water, or plain water if sterile water is unavailable.⁽¹⁾⁽³⁾ Avoid inhalation.

SODIUM CONTENT (mmol):

2mmol per 500mg vial ⁽⁵⁾⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Osmolarity of solutions diluted with sodium chloride 0.9% or glucose 5%, containing approximately 2.5mg of ganciclovir per mL is 310mOsm/kg.⁽³⁾

pH:

After reconstitution with 10mL water for injections, pH = 11⁽¹⁾⁽³⁾

After further dilution pH = 9 to 11⁽³⁾

OTHER COMMENTS:

Complete blood counts and platelet counts should be monitored during therapy. Increased haematological monitoring may be warranted in patients with renal impairment.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Cymevene IV, updated 01/02/2011
2. Martindale "The Complete Drug Reference" accessed via

- <http://www.medicinescomplete.com> (February 2011)
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> (February 2011)
 4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> (February 2011)
 5. British National Formulary No. 61 (March 2011)
 6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2010-11
 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
 8. COSHH report compiled by manufacturer (05/01/2011)
 9. Drug company name: Roche Products
Date contacted: February 2011
 10. Dollery C (1999). Therapeutic Drugs 2nd Edition

Version 2 (NHS Lothian local amendment)

Intravenous

Gelatin

MEDICINE NAME:

Gelatin

TRADE NAME(S):

Gelofusine® Ecobag
Geloplasma®
Isoplex®
Volplex®
Gelaspan®

PRESENTATION OF MEDICINE:

Gelofusine® (succinylated gelatin 4%) - non PVC plastic bags (Ecobags) containing 500mL or 1000mL.^(1a)

Geloplasma® (partially hydrolysed and succinylated gelatin - as anhydrous gelatin 3%) - plasticized PVC bag 500mL Freeflex (polyolefine) bag 500mL.^(1b)

Volplex® (succinylated gelatin 4%) sterile flexible infusion bags 500mL or 1000mL.^{91c)}

Isoplex® (succinylated gelatin 4%) sterile flexible infusion bag 500mL or 1000mL.^(1d)

Gelaspan® (succinylated gelatin 4%) - non PVC plastic bags (Ecobags) containing 500mL or 1000mL.^(1e)

METHOD OF ADMINISTRATION:

IV infusion: The volume and rate of infusion will depend on the condition of the patient.

In severe acute blood loss, 500mL may be given in 5-10 minutes until signs of hypovolaemia are relieved. When given rapidly it should be warmed to no more than 37°C if possible.^{(1a)(1c-e)}

FLUSHING:

Sodium chloride 0.9%,⁽⁹⁾ or glucose 5%.⁽⁹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Severe anaphylactic reactions following administration of gelatin have occurred.^(1a-e) If a severe anaphylactic reaction occurs the infusion should be stopped and supportive treatment given.^(1a-e)

Monitoring: When large volumes are infused, suitable monitoring should be employed to ensure that an adequate haematocrit is maintained (haematocrit should not be allowed to fall below 25%) and that dilutional effects upon coagulation are avoided. Expert haematological advice should be sought, especially in cases of massive blood loss.^(1a-e)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Gelofusine®, Volplex® and Isoplex® may be administered concomitantly with blood. The haemodynamic status of the patient should be monitored.^{(1a)(1c)(d)}

Geloplasma® and Gelaspan® must not be infused through the same infusion line together with blood or blood products.^{(1b)(1e)}

In the absence of compatibility studies, this medicinal product must not be mixed with other medicinal products.^(1b-e)

SODIUM CONTENT (mmol):

145-154mmol/L ^(1a-e)

OSMOLARITY / OSMOLALITY:

Gelofusine®: 274mOsm/L ^(1a)

Isoplex®, Volplex® and Gelaspan®: 284mOsm/L ^(1c-e)

Geloplasma® (cited as osmolality): 295mOsm/kg ^(1b)

pH:

Range 7.1 to 7.7 (Gelofusine® and Gelaspan®). ^{(1a)(1e)}

Range 5.8 to 7.0 (Geloplasma). ^(1b)

Range 6.9 to 7.9 (Volplex® and Isoplex®). ^(1c-1d)

OTHER COMMENTS:

1. Shelf life is reduced to 3 months if stored at a constant temperature of 37°C. If the gelatin has been heated in a warming cabinet it must not be placed back into general stock and the bag should be marked to indicate the date it should be used by. ^(9a)
2. The product should not be mixed with citrated blood, but citrated blood can be given before or after gelatin infusion provided there is adequate flushing of the infusion site. ⁽⁶⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Gelofusine® Ecobag. Last revised December 2008
 - b) Geloplasma®. Last reviewed May 2010
 - c) Volplex®. Last reviewed June 2010
 - d) Isoplex®. Last reviewed June 2010
 - e) Gelaspan®. Last revised June 2011
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com on 10/09/2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 10/09/2012
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com on 10/09/2012
5. British National Formulary No. 64 accessed via <http://www.medicinescomplete.com> on 26/09/2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2012-2013 accessed via <http://www.medicinescomplete.com> on 10/09/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9.
 - a) Drug company name: B Braun Medical Ltd. Date contacted: 13 September 2012
 - b) Drug company name: Beacon Pharmaceuticals. Date contacted: 24 December 2010
 - c) Drug company name: Fresenius Kabi. Date contacted: 13 September 2012

Intravenous

Gentamicin

SEE GUIDANCE ON USE OF GENTAMICIN IN ADULTS ON THE NHS Lothian INTRANET

MEDICINE NAME:

Gentamicin

TRADE NAME(S):

Cidomycin®

Genticin®

Gentamicin (Winthrop, Hospira, B. Braun)

PRESENTATION OF MEDICINE:

Adult injection:

Ampoules or vials containing gentamicin 80mg in 2mL (as sulphate).^{(1a)(1b)(1e)}

Paediatric injection:

Vials containing gentamicin 20mg in 2mL (as sulphate).^(1d)

Solution for infusion:

Infusion containers containing gentamicin (as sulphate); 80mg in 80mL sodium chloride 0.9%; 240mg in 80mL sodium chloride 0.9%; 360mg in 120mL sodium chloride 0.9%.^(1f)

METHOD OF ADMINISTRATION:

Once daily dose regimen:

IV infusion: Administer the required dose over 30 minutes in adults, using an infusion pump as per NHS Lothian Gentamicin Policy.

Multiple daily dose regimens, prophylactic dose or synergistic dose (refer to local unit policies for guidance):

IV injection: Administer by slow IV injection over 3-5 minutes/^{(1a-b)(1d-e)(5)(6)(6a)}

IV infusion: Administer required dose appropriately diluted over 20 to 30 minutes using an infusion pump.^{(1a-e)(5)(6)(6a)}

Administer peripherally with extreme caution. Gentamicin preparations have a low pH so if possible administer via a central venous access device.⁽¹³⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV injection: Can be given undiluted, or diluted with 10-20mL sodium chloride 0.9% or glucose 5% to aid slow administration.⁽¹⁰⁾⁽¹¹⁾

IV infusion: Dilute with 50-100mL sodium chloride 0.9% or glucose 5%.^{(1a)(1b)(1d)(5)} Usual practice in adults is to dilute the required dose in 100mL sodium chloride 0.9% or glucose 5%.

The injection is usually colourless to slightly yellow.^{(1a-b)(1d-f)} Intensity of colour is not related to a loss of potency.⁽⁴⁾

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

24 hours⁽⁴⁾

FLUSHING:

Sodium chloride 0.9% ⁽⁴⁾⁽⁵⁾

Glucose 5% ⁽⁵⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Therapeutic drug level monitoring required. Ensure adequate hydration and monitor renal function to avoid nephrotoxicity. ^(1a-f)

Gentamicin (Hospira) contains sulphites, ^(1b) which can cause allergic-type reactions, including anaphylactic symptoms and bronchospasm, in susceptible people, especially those with a history of asthma or allergy.

EXTRAVASATION:

Extravasation is likely to cause tissue damage because of the low pH of the injection. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Aciclovir, amiodarone, anidulafungin, atracurium, bivalirudin, ciprofloxacin, clarithromycin, cyclophosphamide, daptomycin, diltiazem, esmolol, fluconazole, foscarnet, granisetron, insulin, labetalol, levofloxacin, linezolid, lorazepam, magnesium sulphate, metronidazole, midazolam, milrinone, morphine, ondansetron, pancuronium, ranitidine, remifentanyl, tacrolimus, tigecycline, vecuronium, verapamil, zidovudine. ⁽⁴⁾

Incompatible: Amphotericin, beta-lactam antibiotics (penicillins and cephalosporins), ⁽⁴⁾ diazepam, ^(1f) drotrecogin alpha, ⁽⁴⁾ erythromycin, ^(1a-f) flecainide, ^(1f) furosemide, heparin, hetastarch, propofol, ⁽⁴⁾ sulfadiazine, ^(1f) sodium bicarbonate. ^(1a-f)

Do not give gentamicin by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

Gentamicin activity may be impaired by beta-lactam antibiotics. However gentamicin may be used with penicillins and cephalosporins but the injections should be given at separate sites. ⁽³⁾⁽⁴⁾

Compatible with the following diluents in addition to those listed above: glucose 10%, dextran 40, mannitol 20%, Ringer's solution. ⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

No special handling required. ^(1a-f)

SODIUM CONTENT (mmol):

Adult and paediatric injections: negligible sodium content. ^{(9b)(9d)}

Infusion containers: contains 12mmol sodium per 80mL and 18mmol per 120mL. ^(1f)

OSMOLARITY / OSMOLALITY:

1mg/mL (sodium chloride 0.9%) infusion container: 291mOsm/kg ^(9e)

3mg/mL (sodium chloride 0.9%) infusion container: 295mOsm/kg ^(9e)

80mg in 50-100mL of glucose 5%: 293-285mOsm/kg. ⁽¹²⁾

80mg in 50-100mL of sodium chloride 0.9%: 320-315mOsm/kg. ⁽¹²⁾

Calculated values as follows:

Gentamicin 400mg (as sulphate) in 100mL sodium chloride 0.9% calculated at 315mOsm/L

Gentamicin 400mg (as sulphate) in 100mL glucose 5% calculated at 285mOsm/L

pH:

3 to 5.5 ⁽⁴⁾

OTHER COMMENTS:

1. From July 2010 Some Cidomycin® ampoules were being imported from the Sanofi-Aventis manufacturing site in Hungary. It was being supplied under the same product license as the UK preparation and therefore did not have a separate SPC. Methods of dilution and administration are therefore the same. However, each 2mL ampoule contains 30.3mg of ethanol (used to dissolve the parahydroxybenzoate). The following statement has been included on the leaflet "This medicinal product contains small amounts of ethanol (alcohol), less than 100mg per ampoule" in keeping with excipient guidelines. Alternate manufacturing site import was required into 2011, however, this should now be resolved and further imported product should not be entering the UK supply chain. Cidomycin® vials were unaffected.
2. Constituents:
Cidomycin® contains disodium edetate, methyl parahydroxybenzoate (E2180), propyl parahydroxybenzoate (E216), sulphuric acid, sodium hydroxide and water for injections; ^(1a)
Gentamicin (Hospira) injection contains sodium metabisulphite, disodium edetate, methyl hydroxybenzoate, propyl hydroxybenzoate, sulphuric acid, sodium hydroxide and water for injections; ^(1b)
Gentamicin intrathecal (Winthrop) contains sodium chloride and water for injections; ^(1c)
Gentamicin paediatric (Winthrop) contains disodium edetate, methyl parahydroxybenzoate (E2180), propyl parahydroxybenzoate (E216), sulphuric acid, sodium hydroxide and water for injections; ^(1d)
Genticin® contains sulphuric acid and water for injections; ^(1e)
Gentamicin (Braun) contains disodium edetate, sodium chloride and water for injections ^(1f)

REFERENCES:

1. Summary of Product Characteristics
 - a) Cidomycin®, Sanofi-Avnetis. Last updated 14/09/2010
 - b) Gentamicin, Hospira UK Ltd. Last updated 14/09/2010
 - c) Gentamicin (intrathecal), Winthrop UK Ltd. Last updated 01/12/2009
 - d) Gentamicin (paediatric), Winthrop UK Ltd. Last updated 01/09/2010
 - e) Genticin®, Amdipharm plc. Last updated 01/12/2010
 - f) Gentamicin, B.Braun Medical Ltd. Last revised 17/03/2009
2. Martindale accessed via <http://www.medicinescomplete.com> on 14/04/2011

3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 14/04/2011
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 14/04/2011
5. British National Formulary No. 61, March 2011 pg 350-1
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2010-11 pg 340-1
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. a) Drug company name: Sanofi-Aventis
Date contacted: 29/06/2010
b) Drug company name: Hospira UK Ltd. Date contacted: 29/06/2010
c) Drug company name: Withrop UK Ltd. Date contacted: 29/06/2010
d) Drug company name: Amdipharm plc. Date contacted: 29/06/2010
e) Drug company name: B.Braun Medical Ltd. Date contacted: 29/06/2010
10. Injectable Medicines Administration Guide, 3rd Edition 2010. UCLH NHS Trust
11. DrugDex® Getamycin monograph accessed via <http://www.thomsonhc.com/> (subscription required) on 14/04/2011
12. Bard website, accessed via www.accessabilitybybard.co.uk on 14/04/2011
13. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 3 (NHS Lothian local amendment)

Intravenous

Glyceryl trinitrate

The presence of the excipient propylene glycol in some glyceryl trinitrate preparations can cause adverse effects if its elimination is impaired; see 'adverse effects' section below.

MEDICINE NAME:

TRADE NAME(S):

Glyceryl trinitrate Glyceryl Trinitrate Solution for Infusion (hameln Pharmaceuticals Ltd)
Glyceryl Trinitrate Sterile Concentrate (Hospira UK Ltd)
Nitrocine® (UCB Pharma Ltd)
Nitronal® (Merck Serono)

PRESENTATION OF MEDICINE:

Products (1mg in 1mL) which can be administered without further dilution

Ampoules containing glyceryl trinitrate 5mg in 5mL^{(1a)(b)}
Ampoules containing glyceryl trinitrate 10mg in 10mL^{(1b)(1c)}
Ampoules containing glyceryl trinitrate 25mg in 25mL^{(1a)(1b)}
Vials containing glyceryl trinitrate 50mg in 50mL^(1a-c)

Products (5mg in 1mL) which require dilution before administration

Ampoules containing glyceryl trinitrate 25mg in 5mL. Concentrate for dilution^(1d)
Ampoules containing glyceryl trinitrate 50mg in 10mL. Concentrate for dilution^(1d)

METHOD OF ADMINISTRATION:

For intravenous infusion only. NEVER administer glyceryl trinitrate by IV bolus injection.
^(1a-d)

IV infusion: Administer a 1mg in 1mL solution using an infusion pump. Use a 'ready diluted' preparation if available. Titrate the infusion rate to the haemodynamic response.⁽¹⁾
Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹²⁾ If a central venous access device is unavailable a large peripheral vein can be used; the insertion site must be monitored closely for phlebitis using a recognised infusion phlebitis scoring tool.⁽¹²⁾
Glyceryl trinitrate is incompatible with polyvinylchloride (PVC); use a polyethylene syringe/infusion pack and polyethylene coated administration set (see 'Other Comments' section for further information).^{(1a)(1b)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Glyceryl trinitrate 1mg in 1mL preparations

Glyceryl trinitrate 1mg in 1mL can be administered without further dilution.^(1a-c)

Glyceryl trinitrate 5mg in 1mL preparations

Glyceryl trinitrate 5mg in 1mL must be diluted with either glucose 5% or sodium chloride 0.9% before administration.^(1d)

In adults, usual practice is to dilute to 1mg in 1mL.⁽¹⁰⁾

In children, dilute to a maximum concentration of 400micrograms/mL (but concentration of 1mg/mL has been used via a central venous access device).⁽⁶⁾

EXPIRY TIME TO BE WRITTEN ON THE 'MEDICINE ADDED' LABEL:

24 hours.^(1a-c)

EXAMPLE CALCULATION:

The infusion rate can be calculated from the following equation:

$$\text{Glyceryl trinitrate infusion rate (mL/hour)} = \frac{\text{Dose (micrograms/minute)} \times 60 (\text{minutes})}{\text{Concentration (micrograms/mL)}}$$

For example: To administer a dose of 100micrograms/minute of glyceryl trinitrate using a solution of 50mg in 50mL (1mg in 1mL; 1000micrograms in 1mL), the calculation would look as follows:

$$\text{Glyceryl trinitrate infusion rate} = \frac{100(\text{micrograms/minute}) \times 60}{1,000(\text{micrograms/mL})} = 6\text{mL/hour}$$

FLUSHING:

IV infusion via a central venous access device: Do not flush the central venous access device. After the infusion is discontinued, disconnect the administration set, aspirate the cannula contents and then flush with sodium chloride 0.9%.

IV infusion via peripheral cannula: Flush the cannula with sodium chloride 0.9% at the same speed as the rate of infusion to avoid adverse haemodynamic effects.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects including headache, dizziness, flushing, hypotension and tachycardia may be encountered, particularly for high doses and/or if the infusion is administered too rapidly. Nausea, diaphoresis, restlessness, retrosternal discomfort, abdominal pain and paradoxical bradycardia have been reported. These symptoms should be readily reversible on reducing the rate of infusion or, if necessary, discontinuing treatment.^{(1a)(1b)}

Cardiac monitoring recommended, including frequent blood pressure and heart rate monitoring.⁽⁶⁾

Propylene glycol is an excipient in Nitrocline®^(1c) and the Hospira^(1d) products. In patients with impaired elimination of propylene glycol, for example young children and those with renal impairment it has been associated with toxicity.⁽²⁾⁽⁵⁾ Toxicity includes hypersosmolarity, lactic acidosis and nephrotoxicity.⁽²⁾ In children, limiting the infusion of products containing propylene glycol to 3 days has been recommended.⁽⁶⁾ The hameln generic preparations and the Nitronal® brands of glyceryl trinitrate do not contain propylene glycol.^(1b)

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to low pH and presence of excipients propylene glycol^{(1c)(1d)} and ethanol.^(1d)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse other medicine containing infusions via the same line as glyceryl trinitrate 1mg per 1mL solution as no compatibility information is available.

Glyceryl trinitrate 400micrograms in 1mL infusion is compatible with the following

infusions (it is assumed that medicines meet close to the vascular access device):

Adrenaline, amiodarone, atracurium, cisatracurium, clonidine, dobutamine, dopamine, fentanyl, furosemide, insulin, labetalol, midazolam, milrinone, morphine, noradrenaline, propofol, remifentanyl, sodium nitroprusside, vecuronium.⁽⁴⁾

Incompatible: Hydralazine,⁽⁴⁾ levofloxacin,⁽²⁾ phenytoin.⁽²⁾

SODIUM CONTENT (mmol):

Nil^(9a-d)

OSMOLARITY / OSMOLALITY:

Osmolality of Nitrocine® 276-306mOsmol/kg ^(9c) Infusion of solutions containing propylene glycol^{(1c)(1d)} can lead to hyperosmolarity.⁽²⁾

pH:

3 to 6.5 ^(9a-d)

OTHER COMMENTS:

1. Do not store above 25°C, keep in the original container. ^{(1a)(1b)(1d)}
2. Ethanol is an excipient in the Hospira product.^(1d) There have been reports of ethanol intoxication following high-dose glyceryl trinitrate infusion.⁽²⁾
3. Up to 50% of glyceryl trinitrate is reported to be adsorbed onto polyvinyl chloride (PVC).^(1a-d) The use of PVC containing infusion bags and giving sets is therefore not recommended. However, since the dose of glyceryl trinitrate is titrated to effect, the clinical significance of this is uncertain.⁽⁴⁾ For products containing ethanol, this may also increase overall ethanol exposure.⁽²⁾
4. Glyceryl trinitrate is compatible with polyethylene infusion packs ('Viaflo' infusion bags from Baxter) polypropylene syringes (e.g. BD Plastipak syringes) and polyethylene tubing (e.g. Vygon's Ilectrocath tubing).⁽¹¹⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Nitronal, Merck Serono Ltd. Last revised 13/12/2011
 - b) Glyceryl trinitrate solution for infusion, hameln. Last revised 04/06/2009
 - c) Nitrocine, UCB Pharma Ltd. Last revised 21/01/2009
 - d) Glyceryl trinitrate sterile concentrate, Hospira UK Ltd. Last revised 31/12/2007
2. Martindale accessed via <http://www.medicinescomplete.com> on 30/05/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 30/05/2012
4. Trissel "Handbook on Injectable Drugs" accessed via <http://www.medicinescomplete.com> on 30/05/2012
5. British National Formulary No. 63, March 2012 page 127-129, 998
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003
 - 6a) British National Formulary for Children 2011-2012 pg 3, 104-105
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8.
 - a) COSHH data sheet; Merck Serono January 2008
 - b) COSHH data sheet; hameln Pharmaceuticals January 2007

- c) COSHH data sheet; UCB Pharma March 2008
- d) COSHH data sheet; Hospira UK April 2011
- 9. a) Drug company name: Merck Serono. Date contacted: 04/03/2012
- b) Drug company name: hameln Pharmaceuticals. Date contacted: 09/05/2012
- c) Drug company name: UCB Pharma Ltd. Date contacted: 04/05/2012
- d) Drug company name: Hospira UK. Date contacted: 05/05/2012
- 10. Standard concentrations for infusions used in critical care areas. The Intensive Care Society website (2010) [See Link](#)
- 11. Customer Services, Vygon Corporate & Beckton Dickinson UK Ltd. July 2012
- 12. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 2 (NHS Lothian local amendment)

Intravenous

Granisetron

MEDICINE NAME:

Granisetron

TRADE NAME(S):

Kytril®

Granisetron (Hameln, Martindale)

PRESENTATION OF MEDICINE:

Ampoules containing granisetron 1mg in 1mL (as hydrochloride). Concentration for dilution.^(1a-c)

Ampoules containing granisetron 3mg in 3mL (as hydrochloride). Concentrate for dilution.^(1d)

METHOD OF ADMINISTRATION:

IV injection: give by IV injection over at least 30 seconds.^(1a-d)

IV infusion: over 5 minutes^(1a-d)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

ADULTS

IV injection: Dilute each 1mg to 5mL with sodium chloride 0.9% or glucose 5%.^{(1a-d)(4)}

IV infusion: Dilute in 20-50mL of sodium chloride 0.9% or glucose 5%.^{(1a-d)(4)}

CHILDREN

IV infusion: Dilute in 10-30mL of sodium chloride 0.9% or glucose 5%.^(1a-d)

STABILITY

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypersensitivity reactions and headache.^(1a-d)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Aciclovir, amikacin, aminophylline, bumetanide, cefotaxime, ceftriaxone, cefuroxime, co-trimoxazole, dobutamine, dopamine, fluconazole, folinic acid, furosemide, ganciclovir, gentamicin, hydrocortisone sodium succinate, imipenem with cilastatin, linezolid, magnesium sulphate, methylprednisolone sodium succinate, metronidazole, morphine, piperacillin with tazobactam, propofol, ranitidine, tobramycin, vancomycin, zidovudine.⁽⁴⁾⁽¹⁰⁾

Compatible with the following infusion fluids: Compound sodium lactate (Hartmann's), sodium chloride 0.18% and glucose 4%, sodium lactate, potassium chloride 40mmol/L in sodium chloride 0.9% and glucose 5%.^{(1b-d)(9)}

SODIUM CONTENT (mmol):

Negligible sodium per 1mg vial.^{(1b-c)(9)}

1.4mmol sodium per 3mg vial.^(1d)

OSMOLARITY / OSMOLALITY:

305-318mOsmol/L.^(1a-c)

pH:

pH 4 to 6^(1b-d)

OTHER COMMENTS:

1. Do not store above 30°C.^{(1a)(1c)(1d)} hameln brand must not be stored above 25°C.^(1b)
2. Keep ampoules in outer carton to protect from light.^(1a-d)
3. Do not freeze.^(1a-d)

REFERENCES:

1. Summary of Product Characteristics
 - a) Kytril ampoules 1mg/mL. Roche, last revised 20/07/2011
 - b) Granisetron 1mg/mL concentrate for solution for injection or infusion. hameln, last revised 04/07/2008
 - c) Granisetron 1mg/mL concentrate for solution for injection. Martindale Pharma, last revised 12/01/2012
 - d) Granisetron 3mg/mL concentrate for solution for injection. Mardinale Pharma, last revised 05/03/2012
2. Martindale accessed via <http://www.medicinescomplete.com> on 04/04/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 04/04/2012
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 04/04/2012
5. British National Formulary No. 63, March 2012, pg 264
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012, pg 197
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Roche Products Ltd. Date contacted: 04/04/2012
10. Injectable Medicines Administration Guide. 3rd Edition, University College London Hospitals

Version 2 (NHS Lothian local amendment)

Intravenous

Haem arginate

The manufacturer recommends that when haem arginate is administered to a patient, the name and batch number of the product are recorded in order to maintain a link between the patient and the batch of the product.

MEDICINE NAME:

Haem arginate

TRADE NAME(S):

Normosang® (Orphan Europe)

PRESENTATION OF MEDICINE:

Ampoules containing haem arginate 250mg in 10mL. Concentrate for solution for infusion.⁽¹⁾

METHOD OF ADMINISTRATION (adult):

IV infusion: After appropriate dilution administer over at least 30 minutes using a central venous access device or large brachial vein. Due to the colour of the infusion, use an infusion set with a 15 to 20micron in-line filter.⁽¹⁾⁽²⁾⁽¹¹⁾ (N.B. Most infusion sets incorporate an in line 15micron or 20micron filter; check package).

Use alternate arms each day to limit local perivenous inflammation.⁽¹¹⁾ The dose should not exceed 250mg in 24 hours.⁽¹⁾⁽²⁾⁽⁵⁾ The manufacturer recommends that the infusion should be protected from light during administration, if this is not possible, administer **immediately** after dilution.⁽⁹⁾

After administration of haem arginate, flush the vein with 100mL sodium chloride 0.9%. Initially use 3 or 4 bolus injections of 10mL 0.9% sodium chloride and after this infuse the remaining volume over 10-15 minutes.⁽¹⁾ If vein patency is a problem, dilute the haem arginate in 100mL of 20% human albumin and give over 60 minutes (unlicensed use).⁽¹¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

Dilute immediately prior to administration in 100mL of 0.9% sodium chloride in a glass bottle.⁽¹⁾⁽⁵⁾ If a glass bottle is unavailable, use a plastic container (unlicensed use) and administer **immediately** after preparation.⁽¹¹⁾

FLUSHING:

sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Anaphylactoid reactions: hypersensitivity (e.g. dermatitis medicamentosa and tongue oedema) have occurred rarely.⁽¹⁾

Administration site reactions: temporary pain, swelling and thrombophlebitis at injection site.⁽¹⁾⁽²⁾⁽⁵⁾

Poor venous access can prevent the use of the affected veins for further infusions, necessitating the use of a central venous line.⁽¹⁾

Headache and pyrexia.⁽¹⁾

EXTRAVASATION:

Haem arginate has the potential to cause tissue injury if extravasation occurs because its pH can be greater than 9,⁽⁹⁾ it has a high osmolality greater than 500mOsm/Kg⁽⁹⁾ and contains alcohol and polyethylene glycol as excipients.⁽¹⁾ If extravasation occurs refer to local treatment policies.⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible: Sodium chloride 0.9%.⁽¹⁾

Incompatible: Do not infuse with any other medicines or infusions except sodium chloride 0.9%.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

No information available.⁽⁹⁾

SODIUM CONTENT (mmol):

No information available.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Osmolality:

6mL of Haem arginate in 100mL of sodium chloride 0.9% solution: +/- 712mOsm/kg⁽⁹⁾

9mL of Haem arginate in 100mL of sodium chloride 0.9% solution: +/- 910mOsm/kg⁽⁹⁾

12mL of Haem arginate in 100mL of sodium chloride 0.9% solution: +/- 1100mOsm/kg⁽⁹⁾

pH:

pH: 8.5 to 9.5.⁽⁹⁾

OTHER COMMENTS:

1. Store in the refrigerator (2-8°C) and protect ampoules from light.⁽¹⁾
2. Haem arginate contains 1g of ethanol (96%) per 10mL ampoule and propylene glycol (4000mg/10mL per ampoule).⁽¹⁾ The ethanol content may modify or increase the effect of other medicines and cause central nervous system side-effects, lactic acidosis, kidney and liver toxicity, increase in plasma osmolality, and haemolytic reactions. It may be harmful for those suffering from epilepsy, brain injury or disease, liver disease, alcoholism as well as for pregnant woman and children.⁽¹⁾
3. The dark haem arginate colour may give the plasma an unusual colouring.⁽¹⁾
4. The manufacturer recommends that haem arginate should be prepared in a glass bottle because of its slightly faster degradation in PVC plastic containers.⁽¹⁾
5. Haem arginate is irritant to the veins and may cause thrombophlebitis. Repetitive peripheral use may lead to the loss of the superficial venous system and the consequent need for a central line. Central lines may also, in time, become obstructed with haem deposits. Haem arginate may be administered in 100mL of human albumin (20%) to help reduce these problems (unlicensed use).⁽¹¹⁾
6. See the UKMI Medicines Q and A on NeLM 'How should haem arginate be administered in the management of acute porphyria?'

REFERENCES:

1. Summary of Product Characteristics, Normosang, date of revision of text April 2008
2. Martindale accessed via <http://www.medicinescomplete.com> May 2010
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> May 2010
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> May 2010
5. British National Formulary No. 59, March 2010
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003
a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by manufacturer - Orphan, Europe
9. Drug company name: Orphan Europe
Date contacted: May 2010
10. www.extravasation.org.uk
11. UKMi-Wales Medicines Information Centre: How should haem arginate be administered in the management of acute porphyria. Medicines Q&As. Dec 2009;60.2

Version 2

Intravenous

Haloperidol

Intravenous administration is not the preferred administration route of haloperidol due to an increased risk of QTc-interval prolongation and other cardiac dysrhythmias

MEDICINE NAME:

Haloperidol

TRADE NAME(S):

Haldol®^(1a)
Generic - Goldshield^(1b)

PRESENTATION OF MEDICINE:

Ampoules containing haloperidol 5mg in 1mL solution for injection.

METHOD OF ADMINISTRATION:

IV bolus: Give as slow bolus (i.e. 3-5 minutes). Maximum rate 5mg/minute in an emergency.⁽¹⁰⁾

IV infusion - unlicensed route of administration: Give by continuous infusion with the rate adjusted according to response. The usual rate of administration in adults is 5-10mg/hour.⁽³⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

May be diluted with sodium chloride 0.9% (final concentration must not exceed 750micrograms in 1mL) or glucose 5% (final concentration must not exceed 1mg in 1mL).⁽⁴⁾⁽¹¹⁾

For continuous intravenous infusion via a syringe pump (unlicensed) dilute to a suitable volume with glucose 5% (e.g. 30mg in 50mL).⁽¹⁴⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours.⁽⁴⁾

FLUSHING:

Glucose 5% or sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Monitor blood pressure and heart rate.^{(1a)(3)} Baseline ECG monitoring is recommended prior to treatment in all patients, especially in the elderly and patients with a positive personal or family history of cardiac disease or abnormal findings on cardiac clinical examination. ECG monitoring should be conducted during therapy to monitor for QT prolongation and serious cardiac dysrhythmias. The dose should be reduced if QT is prolonged, and haloperidol should be discontinued if the QTc exceeds 500 milliseconds.^(1a)

EXTRAVASATION:

Extravasation is likely to cause tissue damage due its low pH. Preferably administer via a central venous access device.⁽¹³⁾

SODIUM CONTENT (mmol):

Nil^{(9a)(9b)}

OSMOLARITY / OSMOLALITY:

284mOsmol/L for haloperidol 750micrograms/mL in sodium chloride 0.9% .⁽¹²⁾

252mOsmol/L for haloperidol 1mg in glucose 5%.⁽¹²⁾ see link.

pH:

2.8 to 3.6^{(9a)(9b)}

OTHER COMMENTS:

1. Parenteral administration not recommended for children ⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Haldol (Janssen-Cilag), last revision 23/04/2010 accessed via <http://www.medicines.org.uk/emc>
 - b) Haloperidol (Goldshield plc), last revision 02/09/2010
2. Martindale accessed via <http://www.medicinescomplete.com> January 2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> January 2011
4. Trissel "Handbook on injectable drugs" 16th edition, accessed via <http://www.medicinescomplete.com> January 2011
5. British National Formulary No. 62
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report - Janssen-Cilag Ltd, May 2007
9.
 - a) Drug company name: Janssen-Cilag Ltd. Date contacted 10/02/2011
 - b) Drug company name: Goldshield plc. Date contacted: 10/02/2010
10. Adams S. Intravenous use of haloperidol. Hospital Pharmacy, 1987, vol. 22, 306-307
11. Riker RR, Fraser GL, Cox PM. Continuous infusion of haloperidol controls agitation in critically ill patients. Critical Care Medicine, 1994, vol. 22, no.3, 433-440.
12. Quality Control Department, Imperial College Healthcare NHS Trust.
13. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
14. Paw H, Shulaman R. Drugs in intensive care. 4th edition (2010). Cambridge University Press.

Intravenous

Heparin

NHS Lothian WARNING: For heparin infusions, always use the ampoules containing a ready to use solution of heparin sodium 1000units/ml as per NHS Lothian Heparin Infusion Chart. This solution **does not need to be further diluted before administration.**

Vials containing heparin sodium 5000 units/ml, for restricted use in agreed clinical areas only.

Vials containing heparin sodium 25000 units/ml for restricted use in agreed clinical areas; and for use in the preparation of infusions when the ready to use ampoules are not available from pharmacy. **A notification will be sent from pharmacy to advise if this situation arises.**

MEDICINE NAME:

Heparin

TRADE NAME(S):

Heparin sodium (Leo Laboratories Ltd)

Multiparin®, Monoparin®, Monoparin calcium® (Wockhardt UK Ltd)

PRESENTATION OF MEDICINE:

Heparin sodium

Leo Laboratories:

1000units in 1mL: 1mL amp, 5mL amp, 5mL vial, 10mL amp, 20mL amp

5000units in 1mL: 1mL amp, 5mL amp, 5mL vial

25000units in 1mL: 1mL amp, 5mL vial

Wockhardt:

1000units in 1mL: 1mL amp, 5mL amp, 5mL vial, 10mL amp, 20mL amp

5000units in 1mL: 1mL amp, 5mL amp, 5mL vial

25000units in 1mL: 0.2mL amp, 1mL amp, 5mL vial

METHOD OF ADMINISTRATION:

Administer as an intravenous loading dose according to APTT, followed by a continuous IV infusion using an infusion pump. ^{(1a)(1b)(4)}

Use heparin sodium 1,000 in 1mL. ⁽¹²⁾

Administer intravenous bolus injection over 3-5 minutes. ⁽¹²⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Heparin sodium 1,000units in 1mL can be administered without further dilution.

ONLY EVER UNDERTAKE DILUTION IF NOTIFICATION PROVIDED BY PHARMACY THAT THERE IS A SUPPLY PROBLEM WITH 1000UNIT/ML. IF UNSURE SEEK ADVICE FROM

PHARMACY: If heparin sodium 1,000units in 1mL is unavailable, heparin sodium must be diluted with glucose 5% or sodium chloride 0.9% to produce a concentration of 1,000units in 1mL. ⁽¹²⁾ Invert at least six times to prevent pooling. ⁽⁴⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours⁽¹⁰⁾⁽¹¹⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5% ^{(1a)(1b)(4)}

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. The patient's age, administering heparin too quickly or administering large doses increases the risk of haemorrhage. Measure the activated partial thromboplastin time (APTT) regularly and adjust the rate of continuous infusion accordingly.⁽²⁾
2. Administration is rarely associated with local irritation and skin necrosis.⁽²⁾
3. Risk of heparin-induced thrombocytopenia: monitor platelets before, during and after treatment.⁽²⁾
4. Heparin can suppress adrenal secretion of aldosterone leading to hyperkalemia, particularly in patients such as those with diabetes mellitus, chronic renal failure, pre-existing metabolic acidosis, a raised plasma potassium, or taking potassium sparing drugs. The risk of hyperkalemia appears to increase with duration of therapy but is usually reversible. Plasma potassium should be measured in patients at risk before starting heparin therapy and in all patients treated for more than 7 days.^{(1a)(1b)}

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

For heparin sodium and one other medicine mixed in a single line close to the cannula insertion site:

Compatible: (but may vary dependent on drug concentration; for concentrate solutions consult a pharmacist or specialist texts).⁽¹⁾⁽⁴⁾

Acetylcysteine, adrenaline, alfentanil, aminophylline, clonidine, dobutamine, dopamine, eptifibatide, esmolol, fentanyl, fluconazole, folinic acid, foscarnet, ganciclovir, insulin, linezolid, meropenem, midazolam, morphine, noradrenaline, remifentanil, rocuronium, sodium nitroprusside, vecuronium
In sodium chloride: Furosemide

Incompatible: (this list is not exhaustive; non-inclusion does not imply compatibility)

Alteplase, amiodarone, amphotericin, atracurium, ciprofloxacin, clarithromycin, desferrioxamine, drotrecogin, erythromycin, gentamicin, haloperidol, hydrocortisone sodium succinate, isosorbide dinatrate, labetalol, nicardipine, tobramycin

SPECIAL HANDLING PRECAUTIONS:

None ⁽⁹⁾

SODIUM CONTENT (mmol):

Heparin sodium (Leo Laboratories Ltd):^(9a)
1000units in 1mL, 0.18 to 0.209mmol in 1mL
5000units in 1mL, 0.13mmol in 1mL
25000units in 1mL, 0.65mmol in 1mL

Heparin Sodium (Wockhardt UK Ltd):^(9b)
1000units in 1mL, 0.04mmol in 1mL
5000units in 1mL, 0.2mmol in 1mL
25000units in 1mL, 1mmol in 1mL

OSMOLARITY / OSMOLALITY:

280-300mOsmol.kg⁽¹²⁾

pH:

Heparin sodium injection has a pH of 5 to 7.5 ⁽⁴⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Heparin sodium (Leo Pharma) 1000units/mL: 5mL amp, 5mL vial, 10mL amp, 20mL amp. 5000units/mL: 1mL amp, 5mL amp, 5mL vial. 25000units/mL: 1mL amp, 5mL vial. Last revised November 2007
 - b) Heparin sodium (Wockhardt), 1000units/mL: 1mL amp, 2mL amp, 5mL amp, 5mL vial, 10mL amp, 20mL amp. 5000units last revised 18/09/2009
2. Martindale accessed via www.medicinescomplete.com March 2010
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com March 2010
4. Trissel "Handbook on Injectable Drugs" 14th Edition pg 833
5. British National Formulary No. 58 September 2009 accessed via www.bnf.org/bnf March 2010
6. Royal College of Paediatrics & Child Health; Medicines for Children 2003
 - a) British National Formulary for Children 2009 accessed via <http://bnfc.org/bnfc> March 2010
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer -not available for this product
9.
 - a) Drug Company Name: Leo Pharma. Date contacted: 30/03/2010
 - b) Drug company name: Wockhardt UK Ltd. Date contacted: 09/04/2010
10. Barts and the London NHS Trust, The Royal London Hospital, Heparin IV monograph 2008
11. Injectable Medicines Guide, UCLH, 3rd Edition, 2010
12. Intensive Care Society standards committee, published standard 2010, Medication Concentrations in Critical Care Areas. For details, go to the Intensive Care Society website, under "Guidance", see link to Medication Concentrations in Critical Care Areas (2010)[See Link](#)

Version 3 (NHS Lothian local amendment)

Intravenous

Hydralazine hydrochloride

MEDICINE NAME:

Hydralazine hydrochloride

TRADE NAME(S):

Apresoline ®

PRESENTATION OF MEDICINE:

Ampoules containing hydralazine hydrochloride 20mg powder for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection:

Give by slow IV injection over at least 5 minutes to avoid over rapid reduction of blood pressure.^{(1)(5)(6a)}

If necessary, a repeat injection can be given after an interval of 20-30 minutes.⁽¹⁾⁽⁵⁾ In children a dose can be repeated every 4 - 6 hours as necessary.^{(2)(3)(6a)}

IV infusion: Initial rate 200-300micrograms/minute.⁽¹⁾⁽²⁾⁽⁵⁾ Maintenance 50-150micrograms/minute⁽¹⁾⁽²⁾⁽⁵⁾ adjusted according to patient's blood pressure response and tolerance.⁽¹⁾⁽³⁾

In children under 12 years and neonates infuse at a rate of 12.5-50micrograms/kg/hour.^(6a)

In children over 12 years initially infuse at a rate of 3-9mg/hour.^(6a)

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹⁰⁾ If a central venous access device is unavailable a risk benefit analysis should be made on an individual patient basis. Administer via an infusion pump.

INSTRUCTIONS FOR RECONSTITUTION:

Dissolve the contents of each ampoule in 1mL water for injections to produce 20mg in 1mL. Requires further dilution before administration.⁽¹⁾

DISPLACEMENT VALUE:

Negligible⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV injection: Dilute the reconstituted solution (20mg in 1mL) with 9mL sodium chloride 0.9% to produce 20mg in 10mL.

IV infusion: The manufacturer recommends diluting the reconstituted solution with 500mL sodium chloride 0.9%.⁽¹⁾⁽⁵⁾ In practice 50mg hydralazine is usually diluted to 50mL to produce a 1mg in 1mL solution.⁽¹¹⁾

EXAMPLE CALCULATION:

Infusion rate: The infusion rate can be calculated from the following equation:

$$\text{Hydralazine infusion rate (mL/hour)} = \frac{\text{Dose (microgram/minute)} \times 60 \text{ (minutes)}}{\text{Concentration (micrograms/mL)}}$$

STABILITY

Prepare immediately before use. Discard any remaining solution within 24 hours.

FLUSHING:

Flush with sodium chloride 0.9% ⁽¹⁾⁽⁹⁾

Flush the peripheral cannula with sodium chloride 0.9% at the same rate the medicine was infused to avoid adverse haemodynamic effects.

Do not flush the central venous access device. After the infusion is stopped, disconnect the administration set, aspirate the cannula contents and then flush with sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Tachycardia, palpitations, flushing, anginal symptoms, headache.

Monitoring: Monitor blood pressure and heart rate. ⁽¹⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage as pH is less than 5. ⁽⁹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

IV injection: Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

IV infusion:

Compatible with the following diluents in addition to those listed above: Ringers solution, 5% sorbitol solution. ⁽¹⁾

Incompatible: Glucose. ⁽¹⁾

Hydralazine undergoes rapid decomposition as the pH becomes more alkaline. ⁽⁴⁾⁽¹⁰⁾

SODIUM CONTENT (mmol):

Nil ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

308 - 338mOsmol/L (in sodium chloride 0.9%)

pH:

pH 3.5 to 4.2 once reconstituted.⁽⁹⁾

OTHER COMMENTS:

1. Prepare solution immediately before use.⁽¹⁾
2. Store below 30°C and protect from light during storage.⁽¹⁾⁽²⁾

REFERENCES:

1. Summary of Product Characteristics, Apresoline®, last updated 13/04/2010
2. Martindale accessed via <http://www.medicinescomplete.com> on 06/10/2010
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 06/10/2010
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 11/10/2010
5. British National Formulary No. 60 September 2010, accessed via <http://www.bnf.org/bnf/> on 06/10/2010
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2010-11 accessed via <http://www.bnfc.org/bnfc> on 11/10/2010
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Amdipharm
Date contacted: 11/10/2010
10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#) on 4/2/2011
11. Dade J et al. UKCPA Critical care group Minimum infusion volumes for fluid restricted critically ill patients. 3rd Ed. 2006. accessed via <http://www.ukcpa.org/ukcpadocuments/9.pdf> on 7/12/2010

Version 4 (NHS Lothian local amendment)

Intravenous

Hydrocortisone sodium phosphate (Efcortisol)

N.B. There are three different types of hydrocortisone injection available (sodium phosphate, sodium succinate and acetate); Check you are using the correct salt.

MEDICINE NAME:

Hydrocortisone sodium phosphate

TRADE NAME(S):

Efcortisol® (Sovereign Medical)

PRESENTATION OF MEDICINE:

Ampoules containing hydrocortisone 100mg in 1mL (as sodium phosphate) ⁽⁵⁾

Ampoules containing hydrocortisone 500mg in 5mL (as sodium phosphate) ⁽⁵⁾

METHOD OF ADMINISTRATION:

IV injection (doses less than 500mg; adult patients): Administer by slow IV injection preferably over 3-5 minutes (manufacturer states it should be given over at least half to one minute). ⁽¹⁾

IV infusion: Can be administered as an infusion after appropriate dilution. [Note: NHS Lothian advise a suggested concentration of 1mg/mL]. Can be given by continuous infusion. ⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: Dilute to an appropriate volume with sodium chloride 0.9% or glucose 5%. ⁽⁵⁾

Following dilution the product should appear colourless to pale yellow and free from visible particles. ⁽⁹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours when prepared in the clinical area

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5% ⁽⁵⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Paraesthesia and pain (particularly in the genital region but may radiate over entire body) may follow intravenous injection of the sodium phosphate salt. It is probably related to the rate of injection and usually resolves within a few minutes. ⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device): No information. ⁽⁹⁾

Incompatible: No information. ⁽⁹⁾

SODIUM CONTENT (mmol):

0.66mmol per mL ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information ⁽⁹⁾

pH:

pH 7.5 to 8.5 ⁽⁹⁾

OTHER COMMENTS:

1. Keep ampoules in outer carton. Store below 25°C. ⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Efcortisol Injection, Sovereign Medical. Last revised January 2008
2. Martindale "The Complete Drug Reference" accessed via <http://medicinescomplete.com> on 05/01/2012
3. American Hospital Formulary Service Drug Information accessed via <http://medicinescomplete.com> on 05/01/2012
4. Trissel "Handbook on injectable drugs" accessed via <http://medicinescomplete.com> on 05/01/2012
5. British National Formulary No. 62 September 2011, pg 457
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003, pg 313
 - a) British National Formulary for Children 2011-2012 pg 376
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Amdipharm (Sovereign Medical)
Date contacted: 08/02/2012

Version 5 (NHS Lothian local amendment)

Intravenous

Hydrocortisone sodium succinate (Solu-Cortef)

N.B. There are three different types of hydrocortisone injection available (sodium phosphate, sodium succinate and acetate); Check you are using the correct salt.

MEDICINE NAME:

Hydrocortisone sodium succinate

TRADE NAME(S):

Solu-Cortef®

PRESENTATION OF MEDICINE:

Vials containing 100mg hydrocortisone (as sodium succinate) powder for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION:

Slow IV injection or IV infusion: Give over 1 to 10 minutes.⁽¹⁾
Can be given by continuous infusion in children.^(6a)

INSTRUCTIONS FOR RECONSTITUTION:

Add not more than 2mL of water for injections to 100mg vial.⁽¹⁾

DISPLACEMENT VALUE:

2mL water for injections added to 0.1mL/100mg vial gives 100mg in 2.1mL.⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

For infusion add the reconstituted contents of the vial to 100-1000mL (but not less than 100mL) of glucose 5% or sodium chloride 0.9%⁽¹⁾ to give final concentration of between 100micrograms in 1mL and 1mg in 1mL.⁽¹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

After reconstitution with water for injections, use immediately and discard any remainder.⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Anaphylactoid reactions.⁽¹⁾ Dyspepsia, muscle pain, hypertension, increased sweating.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusion fluids: Glucose 5%, sodium chloride 0.9%, 5% glucose in 0.9% sodium chloride, Ringer's injection sodium chloride 0.45%.⁽⁴⁾

Compatible infusions (it is assumed that medicines meet close to the vascular access device): Aciclovir, aminophylline, digoxin, dopamine hydrochloride, furosemide (in sodium chloride 0.9%), morphine sulphate.⁽⁴⁾

Incompatible: Ciprofloxacin, diazepam, midazolam, phenytoin sodium.⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

No information available ⁽⁹⁾

SODIUM CONTENT (mmol):

Negligible ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information available.⁽⁹⁾

pH:

When reconstituted as directed, the pH of the solution will range from 7.0 to 8.0 ⁽¹⁾

OTHER COMMENTS:

1. Hydrocortisone sodium phosphate 100mg/1mL solution for injection (Efcortisol®) is a ready made solution for administration by slow intravenous injection, intravenous infusion or by intramuscular injection. It is not recommended for intrathecal use. For intrathecal or epidural administration use hydrocortisone sodium succinate (Solu-cortef®).

REFERENCES:

1. Summary of Product Characteristics. Solu-Cortef, last revised October 2012
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 05/01/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 05/01/2012
4. Trissel "Handbook on injectable drugs" 16th Edition 2011 pg 838-851
5. British National Formulary No. 62, September 2011, pg 456-457, 860
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012 pg 375
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Pfizer
Date contacted: August 2012

Intravenous

Imipenem with Cilastatin (as sodium salt)

Contains a PENICILLIN-like structure

Some information in this monograph is brand specific. Ensure you refer to the correct information for the brand used in your Trust.

MEDICINE NAME:

Imipenem with cilastatin (as sodium salt)

TRADE NAME(S):

Primaxin®
Generics: Fresenius Kabi Ltd, Hospira UK Ltd, Hickma (Supplier Kent)

PRESENTATION OF MEDICINE:

Primaxin® vials containing 500mg imipenem (as the monohydrate) with 500mg cilastatin (as the sodium salt) powder for reconstitution.^(1a)

Fresenius Kabi vials containing 500mg imipenem (as 530mg imipenem monohydrate) and 500mg cilastatin (as 530mg cilastatin sodium salt).^(1c)

Fresenius Kabi vials containing 250mg imipenem (as 265mg imipenem monohydrate) and 250mg cilastatin (as 265mg cilastatin sodium salt).^(1c)

Hospira vials containing 500mg imipenem (as 530mg imipenem monohydrate) and 500mg cilastatin (as 530mg cilastatin sodium salt).^(1d)

Hickma (Supplier Kent) vials containing 500mg imipenem (as 530mg imipenem monohydrate) and 500mg cilastatin (as 530mg cilastatin sodium salt).^(1e)

METHOD OF ADMINISTRATION (adult):

Intravenous infusion:

250 to 500mg (as imipenem) over 20 to 30 minutes.^(1a-e)

Doses over 500mg (as imipenem) over 40 to 60 minutes.^(1a-e)

INSTRUCTIONS FOR RECONSTITUTION (adult):

Primaxin®:

Reconstitute each vial with approximately 10mL of sodium chloride 0.9%^(1a) taken from a 100mL infusion container and shake well to form a suspension. Add the reconstituted 500mg vial to the remainder of the 100mL of diluent in the infusion container to give a concentration of 5mg in 1mL (as imipenem). Repeat with an additional 10 mL of infusion solution to ensure complete transfer of vial contents to the infusion solution. Agitate until a clear solution is produced. Reconstituted as directed, intravenous solutions are colourless to yellow but may become a deeper yellow over time. Variation of colour within this range does not affect potency.⁽⁴⁾

The time interval between the beginning of reconstitution and the end of intravenous infusion should not exceed 24 hours.

Fresenius:

Reconstitute each 20mL vial with approximately 10mL of sodium chloride 0.9% from the appropriate infusion solution. Shake well and transfer the resulting suspension to the infusion solution container.

Repeat with an additional 10mL of infusion solution to ensure complete transfer of the vial contents to the infusion solution. Agitate until a clear solution is obtained. The final concentration should be 5mg per 1mL.^(1c)

Hospira:

Reconstitute each 100mL vial with 100mL of sodium chloride 0.9%.^(1d)

Reconstitute each 20mL vial with approximately 10mL of sodium chloride 0.9% from an appropriate infusion solution. Shake well and transfer the resulting suspension to the infusion solution container. Repeat with an additional 10mL of infusion solution to ensure complete transfer of the vial contents to the infusion solution. Agitate until a clear solution is obtained.^(1d)

Hickma:

Reconstitute each 20mL vial with approximately 10mL of sodium chloride 0.9% from an infusion container of 100mL sodium chloride 0.9%. Shake well and transfer the resulting suspension to the infusion solution container.

Repeat with another 10mL of infusion solution to ensure complete transfer of the vial contents to the infusion solution. Agitate the infusion container until a clear solution is obtained. The final concentration should be 5mg per 1mL (as imipenem).^(1e)

DISPLACEMENT VALUE:

For Primaxin® vials the displacement value is 0.85mL when diluted with 100mL.^(9a)

For Fresenius Kabi 500mg vials, the displacement value is 0.85mL when diluted with 100mL.^(9c)

For Hospira vials the displacement value is 1mL when diluted with 100mL.^(9d)

For Hickma vials the displacement value is 2mL when diluted with 100mL.^(9e)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

For Primaxin® the suitable diluent is sodium chloride 0.9%. Glucose 5% can be used in exceptional clinical circumstances where sodium chloride 0.9% is not appropriate^(1a)

Hickma products should only be reconstituted and diluted with sodium chloride 0.9%.^{(1b)(1e)}

Fresenius and Hospira products can be diluted with sodium chloride 0.9% or water for injections.^(1c-d)

The concentration recommended for administration is 5mg in 1mL (as imipenem) i.e. dissolve a 500mg vial in 100mL diluent.^(1a-e)

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

Primaxin® and generic Hospira infusion should be used immediately. The time interval between the beginning of reconstitution and the end of intravenous infusion should not exceed two hours.^{(1a)(1d)}

The infusions made with the generic Fresenius and Hickma preparations should be used immediately.^{(1b)(1c)(1e)}

EXAMPLE CALCULATION (adult):

Calculate Infusion Rate:

Fluid volume (mL) divided by time of administration (minutes). Multiply by 60 to obtain the infusion rate in mL/hour

e.g. for a 500mg (as imipenem) dose: 100mL divided by 20 minutes = 5mL/minute or 300mL/hour

FLUSHING:

IV infusion: Flush with sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Erythema, local pain, induration, fever, thrombophlebitis, nausea, vomiting, anaphylaxis, convulsions.^(1a-e)

The infusion rate may be slowed in patients who develop nausea during infusion.^(1a-e)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusions (it is assumed that medicines meet close to the vascular access device): Aciclovir, anidulafungin, caspofungin, insulin, ondansetron, tigecycline.⁽⁴⁾

Incompatible: Imipenem is incompatible with lactate and should not be reconstituted with diluents containing lactate.^(1a-e)

Imipenem must not be mixed with, or physically added to other antibiotics.^(1a-e)

Fresenius imipenem tends to be less stable in glucose solutions.^(9c)

SPECIAL HANDLING PRECAUTIONS:

Avoid contact with eyes. Do not breathe dust. Avoid prolonged or repeated exposure with skin. Use only with adequate ventilation. Wash thoroughly after handling.⁽⁸⁾

SODIUM CONTENT (mmol):

Primaxin®: contains 1.6mmol (37.6mg) in 500mg (as imipenem) vial.^(1a)

Fresenius: contains 1.6mmol (37.5mg) in a 500mg (as imipenem) vial and 0.81mmol (18.8mg) in each 250mg (as imipenem) vial.^(1c)

Hospira: contains 1.6mmol (37.5mg) in 500mg (as imipenem) vial.^(1d)

Hickma: contains 1.6mmol (37.5mg) in each 500mg (as imipenem) vial.^(1e)

OSMOLARITY / OSMOLALITY:

Primaxin®: 500mg (as imipenem) in 100mL of sodium chloride 0.9%, osmolality = 330mOsm/kg.^(9a)

Fresenius: 500mg (as imipenem) in 100mL sodium chloride 0.9%, osmolality = 280-320mOsmol/kg.^(9c)

Hospira: 500mg (as imipenem) in 100mL sodium chloride 0.9% osmolality = 331-336mOsmol/kg.^(9d)

Hickma: 500mg (as imipenem) in 100mL sodium chloride 0.9%, osmolality = 335-337mOsmol/kg.^(9e)

pH:

pH 6.5 to 8.5 ^{(1c-d)(9a-b)(9e)}

OTHER COMMENTS:

1. MSD cannot guarantee that latex has not been used during the manufacturing process of Primaxin®.^(9a) Fresenius and Hickma states that their products are latex free.^{(9c)(9e)} Hospira state that although mixing and filling operators wear latex gloves, it is unlikely that latex could be found in the filled product.^(9d)
2. Although incompatible with lactate, Primaxin®, Fresenius, Hospira and Hickma products can be given through IV tubing through which a lactate solution is being infused.^(1a-e)
3. Vials that have not been reconstituted should be stored below 25°C.^(1a-c)

REFERENCES:

1. Summary of Product Characteristics
 - a) Primaxin IV injection (MSD), text revised October 2011
 - b) Imipenem/cilastatin (Ranbaxy), text revised 17/06/2010
 - c) Imipenem/cilastatin (Fresenius Kabi Ltd), text revised 07/08/2009
 - d) Imipenem/cilastatin (Hospira UK Ltd), text revised 04/02/2013
 - e) Imipenem/cilastatin (Hickma; Supplier Kent Pharmaceuticals Ltd), text revised 11/01/2012
2. Martindale "The Complete Drug Reference" accessed www.medicinescomplete.com December 2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com December 2012
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com in December 2012
5. British National Formulary No. 65 accessed via www.bnf.org in July 2013
6. British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. Safety Data Sheet for Primaxin® IV compiled by Merck & Co. Updated 23/07/2008
9.
 - a) Drug company name: MerckSharp & Dohme Limited. Date contacted: 23/07/2012
 - b) Drug company name: Ranbaxy. Date contacted: 08/06/2011
 - c) Drug company name: Fresius Kabi Ltd. Date contacted: 02/06/2011
 - d) Drug company name: Hospira. Date contacted: 16/11/2011
 - e) Drug company name: Fannin (UK) Ltd. Date contacted: 04/10/2012

Version 6

Intravenous

Insulin (soluble), human

Insulin prescriptions must include the term 'units' next to the dose of insulin. Abbreviations such as “U” or “IU” must not be used ⁽¹¹⁾⁽¹²⁾

MEDICINE NAME:

Insulin (soluble), human

TRADE NAME(S):

Humulin S[®] (prb)
Human Actrapid[®] (pyr)

PRESENTATION OF MEDICINE:

Vials (10mL) containing insulin (soluble), human 100units per mL ^{(1a)(1b)}

METHOD OF ADMINISTRATION:

Continuous infusion: Administer as a 1unit in 1mL dilution using a syringe pump. ⁽⁵⁾⁽¹⁰⁾

IV injection (for hyperkalaemia): Administer 5-10units insulin with 50mL glucose 50% over 5-15 minutes. ⁽⁵⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Continuous Infusion: Dilute 50units insulin to 50mL sodium chloride 0.9%. ⁽¹⁰⁾

IV injection (for hyperkalaemia): Add 5 to 10units insulin to 50mL glucose 50%. ⁽⁵⁾

An insulin syringe must always be used to draw up and prepare insulin. ⁽¹¹⁾⁽¹²⁾

If an infusion bag is used ensure insulin is not injected into the dead space of injection port. ⁽⁵⁾

EXPIRY WHEN PREPARED IN A CLINICAL AREA:

Human Actrapid[®]: 24 hours ^(1a)

Humulin S[®]: No information

FLUSHING:

Flush with sodium chloride 0.9% ⁽⁵⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypoglycaemia: monitor blood glucose levels. ^{(1a)(1b)}

Systemic allergic anaphylaxis can occur rarely. ^{(1a)(1b)}

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not administer insulin by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

Compatible (it is assumed that medicines meet in the administration set close to the cannula insertion site): Amiodarone, heparin, lidocaine, magnesium sulphate, midazolam, milrinone, morphine, potassium chloride, propofol, terbutaline, vancomycin, verapamil. ⁽⁴⁾

Many drugs are compatible with insulin - contact Pharmacy for a full list.

Compatible infusion fluids: Sodium chloride 0.9%, glucose 5%, glucose 5% containing 40mmol potassium chloride.⁽⁴⁾

Incompatible: Aminophylline, dopamine and digoxin.⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

No information available ^{(9a)(9b)}

SODIUM CONTENT (mmol):

Human Actrapid®: Approximately 0.0047mmol per mL (110micrograms/mL) ^(9a)

Humulin S®: No information available

pH:

pH 6.9 to 7.8 ⁽²⁾

OTHER COMMENTS:

1. Preserved with glycerol and m-cresol. ^{(1a)(1b)}
2. Loss of drug into bag, plastic syringe or giving set may occur. ^{(2)(4)(5)(9a)}
3. If infusion bag is used ensure insulin is not injected into dead space of injection port. ⁽⁵⁾
4. Protect from sunlight. ^{(1a)(1b)}
5. Store between 2-8°C. Once in use, the vial should be kept between 15-25°C. ^{(1a)(1b)}
6. Humulin S® vials may be used for up to 28 days once opened. ^(1b)
7. Actrapid® vials may be used for up to 6 weeks once opened. ^(1a)
8. Do not freeze. ^{(1a)(1b)}

REFERENCES:

1. Summary of Product Characteristics
 - a) Human Actrapid®. Date of revision of text 07/12/2007
 - b) Humulin S®. Date of revision of text 21/04/2010
2. Martindale accessed via <http://www.medicinescomplete.com> on 21/04/2010
3. American Hospital Formulary Service Drug Information"
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 21/04/2010
5. British National Formulary No. 59 accessed via <http://www.bnf.org/bnf/> on 21/04/2010
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9.
 - a) Drug company name: Novo Nordisk
Date contacted: 10/07/2009
 - b) Drug company name: Eli Lilly Date contacted: 15/07/2009
10. Towards standardisation of drug infusion concentrations in UK critical care units. M Borthwick et al; Journal of Intensive Care Society; Vol 10; No. 3; July 2009
11. NPSA/2010/RRR013 Rapid response report 16 June 2010; Safer administration of insulin
12. Rapid Response Report NPSA/2010/RRR013: Safer administration of insulin, June 2010, Supporting Information

Version 2 (NHS Lothian local amendment)

Intravenous

Isoniazid

MEDICINE NAME:

Isoniazid

TRADE NAME(S):

Isoniazid (Alliance Pharmaceuticals)

PRESENTATION OF MEDICINE:

Ampoules containing isoniazid 50mg in 2mL.⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3-5 minutes.⁽¹⁾⁽¹⁰⁾

It is recommended to give an intravenous dose slowly as an undiluted bolus injection, although other methods may be employed.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Recommended to give undiluted but can be diluted⁽⁹⁾ if necessary.

The drug company recommends water for injections as a suitable diluent, however, it is rarely used in practice because it is likely to cause hyponatraemia.⁽⁹⁾

STABILITY

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9%.⁽⁹⁾⁽¹⁰⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Fever, skin conditions (including erythema multiforme), and rarely lupoid syndrome, pellagra, purpura and haematological reactions have occurred during isoniazid therapy.⁽¹⁾⁽⁴⁾

EXTRAVASATION:

No information available.⁽⁹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

The drug company recommends water for injections as a suitable diluent, however, it is rarely used in practice because it is likely to cause hyponatraemia.⁽⁹⁾

Incompatible: Glucose⁽⁹⁾

SPECIAL HANDLING PRECAUTIONS:

Avoid contact with eyes, skin and clothing. Remove contaminated clothing.⁽⁸⁾

SODIUM CONTENT (mmol):

Negligible.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information.⁽⁹⁾

pH:

5.6 to 6.⁽⁹⁾

OTHER COMMENTS:

1. Protect from light.⁽¹⁾
2. Maximum storage temperature is 25°C.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Isoniazid (Alliance Pharmaceuticals), last updated on eMC 07/01/2003
2. Martindale accessed via <http://www.medicinescomplete.com> on 09/09/2010. No information.
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 09/09/2010. No information.
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 09/09/2010. No information.
5. British National Formulary No. 60 accessed 09/09/2010
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003. No information.
 - a) British National Formulary for Children 2010-11 accessed 09/09/2010
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. Material Safety Data Sheet, Isoniazid United States Pharmaceutical Convention, Inc. 30/01/2001
9. Drug company: Alliance Pharmaceuticals
Date contacted: 09/09/2010
10. Injectable Medicine Administration Guide, UCL Hospitals, 3rd Edition 2010

Version 3 (NHS Lothian local amendment)

Intravenous

Isoprenaline sulphate

Unlicensed preparation.

MEDICINE NAME:

Isoprenaline sulphate

TRADE NAME(S):

Isoprenaline sulphate (South Devon Healthcare Torbay)

PRESENTATION OF MEDICINE:

Ampoules containing 2.25mg isoprenaline sulphate in 2mL. Sterile concentrate for injection.

N.B. Other strengths of isoprenaline sulphate may be in use locally; contact Pharmacy for information.

METHOD OF ADMINISTRATION:

Must be diluted before administration.

IV injection: Give by slow IV injection at a rate of 5-20micrograms per minute, adjusted according to response.⁽⁴⁾

IV infusion: Give at a rate of 0.5-20micrograms per minute using a syringe pump, adjusted according to response.⁽²⁾⁽⁴⁾

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV injection: Dilute to at least 20micrograms per mL with glucose 5% or sodium chloride 0.9%.

IV infusion: Dilute 2mL (one ampoule of 2.25mg in 2mL isoprenaline sulphate injection) with 500mL glucose 5%⁽⁴⁾ to make a 4.5micrograms per mL solution. Usual concentrations for intravenous infusion are 2.25-4.5micrograms in 1mL.⁽³⁾

More concentrated solutions i.e. 2.25-4.5mg in 50mL glucose 5% are often used in critical care areas⁽¹⁰⁾ for administration via a central venous access device using an infusion pump.

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours.

EXAMPLE CALCULATION:

The calculation is specific for isoprenaline sulphate 2.25mg in 2mL, sterile concentrate for injection. If another isoprenaline preparation is being used please contact your pharmacy department for advice.

Infusion rate: The infusion rate can be calculated from the following equation:

$$\text{Isoprenaline sulphate infusion rate (mL/hour)} = \frac{\text{Dose (microgram s/minute)} \times 60 \text{ (minutes)}}{\text{Concentration (microgram s/mL)}}$$

For example: **To administer a dose of 6.75micrograms/minute of isoprenaline sulphate using a solution of 2.25mg in 50mL (45micrograms in 1mL), the calculation should look as follows:**

$$\text{Isoprenaline sulphate infusion rate} = \frac{6.75 \text{ (microgram s/minute)} \times 60 \text{ (minutes)}}{45 \text{ (microgram s/mL)}} = 9 \text{ mL/hour}$$

The table provided by the following 'link' shows example calculations.

FLUSHING:

Do not flush the vascular access device. After the infusion is discontinued, disconnect the giving set, aspirate the cannula contents and then flush with sodium chloride 0.9% or glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Tachycardia, cardiac arrhythmias, palpitations, hypotension, tremor, headache, sweating and facial flushing.⁽²⁾

Monitor ECG, arterial blood pressure, heart rate, urine flow, central venous pressure, blood pH, blood pCO₂ or bicarbonate, and cardiac output.⁽³⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to low pH.⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Magnesium sulphate infusion, potassium chloride infusion.⁽⁴⁾ Do not infuse with any other medicines.

Incompatible: Aminophylline, furosemide, sodium bicarbonate, solutions with pH above 6 as isoprenaline sulphate displays significant decomposition at a pH value above approximately 6.⁽⁴⁾ The pH of sodium chloride 0.9% is 4.5-7.⁽⁴⁾ Since isoprenaline may undergo a significant decomposition at pH greater than 6, glucose 5% is the diluent of choice for intravenous infusion.

SPECIAL HANDLING PRECAUTIONS:

No special handling requirements.⁽⁸⁾

SODIUM CONTENT (mmol):

0.067mmol/mL⁽⁹⁾

OSMOLARITY / OSMOLALITY:

2.25mg in 500ml 5% glucose 280 mOsmol/L⁽¹¹⁾

4.5mg in 50ml 5% glucose 327 mOsmol/L⁽¹¹⁾

pH:

2.5 - 3⁽⁹⁾

OTHER COMMENTS:

1. Isoprenaline sulphate 1.125mg is equivalent to isoprenaline hydrochloride 1mg.⁽⁹⁾
2. Discard the injection if it is pinkish or darker than slightly yellow or contains a precipitate.⁽³⁾
3. Protect unopened ampoules from light.⁽³⁾
4. Contains sodium metabisulphite.⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics - not available
2. Martindale "The Complete Drug Reference". Accessed via <http://www.medicinescomplete.com> on 25/10/2010
3. American Hospital Formulary Service Drug Information. Accessed via <http://www.medicinescomplete.com> on 25/10/10
4. Trissel "Handbook on injectable drugs". Accessed via <http://www.medicinescomplete.com> on 25/10/10
5. British National Formulary 60
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2008
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report complied by manufacturer
9. Drug company name: Torbay PMU
Date contacted: August 2010
10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
11. Quality Assurance Department, Charing Cross Hospital

Version 2 (NHS Lothian local amendment)

Intravenous

Ketorolac trometamol

MEDICINE NAME:

Ketorolac trometamol

TRADE NAME(S):

Toradol®
Ketorlac trometamol (Beacon Pharmaceuticals)

PRESENTATION OF MEDICINE:

Ampoule containing ketorolac trometamol 30mg in 1mL solution for injection.^(1a-b)

METHOD OF ADMINISTRATION (adult):

IV injection: Give by slow IV bolus over no less than 15 seconds ^{(1a-b)(2)(3)(4)(6)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

Dilution not necessary ^(1a-b)

If dilution is required either sodium chloride 0.9% or glucose 5% can be used.^(1a-b)

STABILITY

Prepare immediately before administration.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5% ^(1a-b)

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Anaphylaxis, bradycardia, bronchospasm and flushing. Hypertension, hypotension, palpitations, heamatoma, flushing, pallor. Pain at the injection site. Monitor blood pressure and heart rate. Major risk of gastric bleeding or operative site bleeding.^(1a-b)

EXTRAVASATION:

As ethanol is an excipient, this product has the potential to cause tissue injury if extravasation occurs. If extravasation does occur, refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Ketorolac should not be mixed in a small volume (e.g. in a syringe) with morphine sulphate, pethidine hydrochloride, promethazine hydrochloride or hydroxyzine hydrochloride as precipitation of ketorolac will occur.^(1a-b)

No compatibility data is available, therefore, do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion. Flush the line both before and after giving the injection.

Compatible infusion fluids: Ringer's solution,^(1a-b) lactated Ringers,^(1a-b) glucose 5%^(1a-b) and sodium chloride 0.9%.^(1a-b)

SODIUM CONTENT (mmol):

Toradol® 10mg in 1mL contains 7.45mg sodium chloride^(9a) - this represents 127mmol

Both 30mg in 1mL presentations contain 4.35mg sodium chloride^(9a-b) - this represents 74mmol

OSMOLARITY / OSMOLALITY:

Information on osmolality of ketorolac trometamol ampoule solutions is not available

pH:

5.7 to 6.7 (10mg/mL solution) ^{(2)(8b)}

6.9 to 7.9 ^{(4)(9a-b)}

OTHER COMMENTS:

1. Onset of analgesic effects approximately 30 minutes.^(1a-b) Median duration of analgesia is generally 4-6 hours.^(1a-b)
2. Maximum duration of treatment should not exceed 2 days.^{(1a-b)(5)}
3. Do not store above 30°C.^(1b) Do not refrigerate or freeze.^(1a)
4. Keep ampoules in the outer carton^(1a-b) and protect from light.^{(1b)(2)(3)(4)}
5. Injection contains ethanol, sodium chloride and water,^(1a) additionally sodium hydroxide^(1b)
6. Precipitation may occur in solutions having a relatively low pH value.⁽⁴⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Toradol®, Roche Products Ltd, last revised 21/10/2013
 - b) Generic, Beacon Pharmaceuticals, last revised 27/03/2011
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 08/02/2013
3. American Hospital Formulary Service Drug Information accessed via www.medscape.com on 08/02/2013
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 08/02/2013
5. British National Formulary No. 66, September 2013, pg 837
6. British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8.
 - a) COSHH report compiled by manufacturer (Roche) - Safety data sheet for ketorolac tromethamine 24/08/2010
 - b) COSHH report compiled by manufacturer (Beacon) - Safety data sheet for ketorolac tromethamine 09/01/2009
9.
 - a) Drug company name: Roche Products Ltd. Date contacted: 28/02/2012
 - b) Drug company name: Beacon Pharmaceuticals. Date contacted: 19/12/2011

Intravenous

Immunoglobulin, human normal (Kiovig)

Brands of normal human immunoglobulin are not interchangeable.

Record the batch number and expiry date from each bottle used in the patient's case notes or on the drug chart

MEDICINE NAME:

Immunoglobulin, human normal

TRADE NAME(S):

Kiovig®

PRESENTATION OF MEDICINE:

Vials containing human normal immunoglobulin 100mg in 1mL (10%) solution for infusion:

1g in 10mL

2.5g in 25mL

5g in 50mL

10g in 100mL

20g in 200mL

30g in 300mL.⁽¹⁾

METHOD OF ADMINISTRATION:

IV infusion: Give at an initial rate of 0.5mL/kg/hour for 30 minutes. If well tolerated, gradually increase the rate of administration to a maximum of 6mL/kg/hour.

The recommended schedule is:

0.5mL/kg/hour for 30 minutes

1mL/kg/hour for at least 5 minutes

2mL/kg/hour for at least 5 minutes

4mL/kg/hour for at least 5-10 minutes

6mL/kg/hour for the rest of the infusion.⁽⁹⁾

Use an infusion pump.

Bring the infusion up to room or body temperature before giving.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

If dilution is required, dilute with an equal volume of glucose 5% solution to make a final concentration of 50mg/mL (5% immunoglobulin).⁽¹⁾

EXAMPLE CALCULATION:

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse reactions are more likely to occur in patients receiving normal immunoglobulin for the first time, following a prolonged period between treatments, or when a different brand of normal immunoglobulin is administered.

Adverse reactions include chills, headache, fever, vomiting, nausea, allergic reactions,

arthralgia, low blood pressure and moderate low back pain. These may be related to the infusion rate. If they occur, reduce the rate or stop the infusion.

Anaphylactic reactions are rare but can occur even in patients who have tolerated previous treatment with normal immunoglobulin.

Monitoring:

Monitor the patient (temperature, blood pressure, pulse, respiratory rate) before starting the infusion, throughout the infusion and for 1 hour after the first infusion or 20 minutes after subsequent infusions.

Monitor urine output and serum creatinine levels. Patients must be well hydrated.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines.

SODIUM CONTENT (mmol):

Negligible.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

240-300mOsmol/kg.⁽⁹⁾

pH:

4.6-5.1⁽⁹⁾

OTHER COMMENTS:

1. Store in a refrigerator (2°C - 8°C). Do not freeze.
2. Keep the vial in the outer carton to protect from light.
3. The product may be stored at room temperature (not more than 25°C) for up to 1 year. The date of transfer to room temperature and the end of the 1 year period should be recorded on the outer carton. Once the product has been stored at room temperature do not return to the refrigerator; discard if not used by the end of the 1 year period.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Kiovig[®] accessed via www.baxterhealthcare.co.uk date of revision of text 7/2011
2. Martindale accessed via www.medicinescomplete.com on 21/09/2011
3. American Hospital Formulary Service (no relevant information)
4. Trissel 'Handbook on Injectable Drugs' accessed via www.medicinescomplete.com on 21/09/2011
5. British National Formulary no. 62 Sept 2011 accessed via www.bnf.org.uk on 21/09/2011
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2010-11 accessed via www.bnfc.org on 21/09/2011
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)

8. COSHH report compiled by manufacturer (not available)
9. Drug Company Name: Baxter. Date contacted:28/04/2011, 22/09/2011

Version 1

Intravenous

Labetalol hydrochloride

MEDICINE NAME:

Labetalol hydrochloride

TRADE NAME(S):

Trandate Injection®

PRESENTATION OF MEDICINE:

Ampoules containing labetalol 100mg in 20mL (as hydrochloride) solution for injection ⁽¹⁾⁽⁵⁾

METHOD OF ADMINISTRATION:

Preferably administer via a central venous access device line to avoid potential venous irritation as the preparation has a low pH.

Administration via a rate controlled infusion pump is advised to facilitate accurate dosage. ⁽³⁾⁽⁴⁾

ADULTS

IV injection: May be given undiluted by slow IV injection. Maximum rate 50mg per minute repeated if necessary at 5 minute intervals up to maximum total dose of 200mg until a satisfactory response occurs. ⁽¹⁾⁽²⁾

IV infusion: Dilute in a compatible infusion fluid to 1mg in 1mL. ⁽¹⁾⁽³⁾⁽⁴⁾ If fluid restricted may be infused undiluted. ⁽⁶⁾ Usual maximum rate of intravenous infusion 2mg per minute but refer to summary of product characteristics for details as rates differ depending on indication.

CHILDREN

IV injection: May be given undiluted by slow IV injection over at least 1 minute. ⁽⁶⁾
1 month to 12 years - 250-500micrograms/kg as a single dose; maximum 20mg. ^{(6)(6a)}
12 to 18 years - as per adult guidance above. ^{(6)(6a)}

IV infusion: Dilute in a compatible infusion fluid to 1mg in 1mL. ^{(6)(6a)} If fluid restricted may be infused undiluted. ^{(6)(6a)}

Neonate: 500micrograms/kg/hour adjusted at intervals of at least 15 minutes according to response; maximum 4mg/kg/hour. ^{(6)(6a)}

Child 1 month to 12 years: initially 0.5-1mg/kg/hour adjusted at intervals of at least 15 minutes according to response; maximum 3mg/kg/hour. ^{(6)(6a)}

Child 12 to 18 years: 30-120mg/hour adjusted at intervals of at least 15 minutes according to response. ^{(6)(6a)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Dilute to a concentration of 1mg in 1mL ⁽¹⁾⁽⁵⁾ with glucose 5% IV infusion ⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾⁽⁵⁾⁽⁶⁾ or sodium chloride 0.9%. ⁽²⁾⁽³⁾⁽⁶⁾

STABILITY

Prepare immediately before use.

FLUSHING:

IV injection: Flush with sodium chloride 0.9% or glucose 5%

IV infusion via a central venous access device: Do not flush. After completion of infusion, disconnect giving set, aspirate cannula contents and then flush with sodium chloride 0.9%.

IV infusion via peripheral cannula: Flush the cannula with sodium chloride 0.9% at the same speed as the rate of infusion to avoid haemodynamic effects.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Orthostatic/postural hypotension, monitor blood pressure; the patient should remain lying down for more than 3 hours after administration.⁽¹⁾⁽²⁾⁽³⁾⁽⁵⁾

Bronchospasm in patients with asthma/obstructive airways disease or history of asthma/obstructive airways.⁽¹⁾

It is desirable to monitor the heart rate after injection and during infusion. In most patients, there is a small decrease in the heart rate; severe bradycardia is unusual but may be controlled by injecting atropine 1-2mg intravenously.⁽¹⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage as pH is less than 5.⁽⁹⁾ If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

When giving labetalol by IV injection do not administer via an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the labetalol.

Keep labetalol infusions separate from other infusions wherever possible. This is due to the possibility of the second infusion affecting the infusion rate of labetalol and therefore affecting heart rate and blood pressure.

Incompatible (N.B. Exclusion from this list does NOT assume compatibility):

Incompatible with sodium bicarbonate injection BP 4.2% w/v⁽¹⁾ and sodium bicarbonate 5%.⁽²⁾⁽³⁾⁽⁴⁾

Immediate formation of precipitate with ceftriaxone, furosemide, heparin, insulin, pantoprazole and thiopental.⁽²⁾ A white precipitate has been observed following concomitant infusion of alkaline drugs and labetalol injection.⁽³⁾

SPECIAL HANDLING PRECAUTIONS:

None⁽¹⁾

SODIUM CONTENT (mmol):

Small and variable amounts of sodium hydroxide.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information available ⁽⁹⁾

pH:

pH 3.5 to 4.5 ⁽⁹⁾

OTHER COMMENTS:

1. After bolus injection, the maximum hypotensive effect usually occurs within 5 to 15 minutes.⁽¹⁾⁽²⁾⁽³⁾ Effective duration is usually about 6 hours, but may be as long as 18 hours.⁽¹⁾⁽²⁾
2. The product should be protected from light during storage but there is no requirement to protect from light during administration.⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics, Trandate® (labetalol) UCB, last revised 02/02/2010
2. Martindale accessed via www.medicinescomplete.com on 22/01/2010
3. American Hospital Formulary Service Drug Information. Accessed via www.medicinescomplete.com on 22/01/2010
4. Trissel "Handbook on injectable drugs" 15th Edition accessed via www.medicinescomplete.com on 22/01/2010
5. British National Formulary No. 58, September 2009, accessed via <http://www.bnf.org/bnf/> on 22/01/2010
6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003
a) British National Formulary for Children 2009 accessed via <http://www.bnf.org/bnfc> on 22/01/2010
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#).
8. COSHH report compiled by the manufacturer. Product Safety Data Summary. Trandate® (labetalol) UCB. Date originally reviewed 10/11/2005
9. Drug company name: UCB Pharma
Date contacted: January 2010

Version 5 (NHS Lothian local amendment)

Intravenous

Lepirudin

Discontinued in the UK 01/04/2012; Expiry of last batch produced 31st August 2013

Unlicensed medicine in use.

MEDICINE NAME:

Lepirudin

TRADE NAME(S):

Refludan®

PRESENTATION OF MEDICINE:

Each vial contains 50mg of lepirudin as powder for solution for injection or infusion ⁽¹⁾⁽⁵⁾

METHOD OF ADMINISTRATION:

Lepirudin is administered as an intravenous injection followed by a continuous infusion. ⁽¹⁾

Intravenous injection: over 3-5 minutes. ⁽⁹⁾

Continuous intravenous infusion administered peripherally or centrally using an infusion pump. Maximum infusion rate in adult patients is 150micrograms/kg bodyweight/hour. ⁽¹⁾⁽⁵⁾ This dosing is valid for patients up to 110kg bodyweight. In patients with a bodyweight exceeding 110kg the initial dosage should not be increased beyond the 110kg bodyweight dose. The dosing for both intravenous injection and infusion should be modified in renal impairment and the rate of continuous infusion adjusted according to aPTT results. ⁽¹⁾
See example calculation section; Tables 1-3 for further information.

The safety and effectiveness of lepirudin has not been established in children. ⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

For reconstitution inject 1mL of water for injections or sodium chloride 0.9% into the vial and shake gently to produce a clear, colourless solution. This is obtained usually within less than 3 minutes. ⁽¹⁾
Use the reconstituted solution immediately to prepare the final IV solution for injection or infusion ⁽¹⁾ (see below).

DISPLACEMENT VALUE:

No information. ⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

For IV injection:

To prepare a final solution for injection, transfer the contents of one reconstituted vial containing 50mg lepirudin into a 10mL polypropylene syringe. Dilute with glucose 5% or sodium chloride 0.9% to a total volume of 10mL giving a final lepirudin concentration of **5mg in 1mL** solution. ⁽¹⁾

Continuous IV infusion:

To prepare a final solution for infusion transfer the contents of two reconstituted vials each containing 50mg lepirudin into a 50mL syringe. Dilute with glucose 5% or sodium chloride 0.9% to a total volume of 50mL giving a final lepirudin concentration of **2mg in 1mL**. ⁽¹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

Infusion must be changed at least every 12 hours after the start of the infusion.⁽¹⁾

EXAMPLE CALCULATION:

The following tables 1-3 shows calculation of the volume for injection, infusion rate and how to adjust the infusion rate according to the aPTT. See Summary of Product Characteristics for guidance on dose adjustment in renal impairment.

Table 1: Slow injection volume (mL) using a 5mg in 1mL IV solution							
Dose (micrograms/kg)	Patient body weight						
	50kg	60kg	70kg	80kg	90kg	100kg	110kg
200	2	2.4	2.8	3.2	3.6	4	4.4
400	4	4.8	5.6	6.4	7.2	8	8.8

For other doses use the calculation below:

$$\text{Injection volume (mL)} = \frac{\text{dose (micrograms/kg)} \times \text{body weight (kg)}}{5000}$$

Table 2: Continuous infusion rate (mL/hour) using a 2mg in 1mL IV solution							
Dose (micrograms/kg)	Patient body weight						
	50kg	60kg	70kg	80kg	90kg	100kg	110kg
100	2.5	3	3.5	4	4.5	5	5.5
150	3.8	4.5	5.3	6	6.8	7.5	8.3

For other doses use the calculation below:

$$\text{Injection volume (mL/hr)} = \frac{\text{dose (micrograms/kg/hour)} \times \text{body weight (kg)}}{2000}$$

Table 3: Adjustment of infusion rate according to the aPTT⁽¹⁾	
aPTT	Rate of infusion
< Target range	Increase by 20%
> Target range	Stop infusion for 2 hours, restarting with a 50% reduction in the infusion rate

Measure the aPTT 4 hours after the start of therapy, any dose alterations, and at least once daily otherwise adjusting the infusion rate accordingly (Table 3).

Generally an infusion rate of 0.21mg/kg/hr should not be exceeded without checking for coagulation abnormalities.⁽¹⁾

FLUSHING:

Sodium chloride 0.9% or glucose 5%.⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Lepirudin may cause allergic reactions including anaphylaxis and shock. Fatal anaphylactic reactions have been reported in patients re-exposed to lepirudin with second or subsequent treatment course. Treatment with lepirudin should only be undertaken in areas where medical assistance and treatment for anaphylactic reactions are available. There may be cross sensitivity with other hirudins e.g. bivalirudin. Haemorrhagic effects including bleeding from puncture sites and wounds may occur.⁽¹⁾⁽⁵⁾

EXTRAVASATION:

Extravasation is not expected to cause tissue damage.⁽⁹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or infusions.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

No information available.⁽⁸⁾

SODIUM CONTENT (mmol):

No information.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Osmolality 240 to 320mOsm/kg.⁽⁹⁾

pH:

Approximately 7.⁽¹⁾⁽⁴⁾

OTHER COMMENTS:

1. Safety and effectiveness has not been proven in children.⁽¹⁾
2. Store unused vials below 25°C.⁽¹⁾
3. Vial stopper is latex free.⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics for Refludan. Celgene Ltd, date last revised 05/02/2007
2. Martindale "The Complete Drug Reference" accessed via

- <http://www.medicinescomplete.com> accessed 03/08/2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> accessed 03/08/2011
 4. Trissel "Handbook on injectable drugs" 16th Edition December 2010, accessed via [medicines complete.com](http://www.medicinescomplete.com) 03/08/2011
 5. British National Formulary No. 61, March 2011 accessed via www.bnf.org.uk 03/08/2011
 6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003
 - a) British National Formulary for Children 2010-11 accessed via www.bnf.org/bnfc 03/08/2011
 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
 8. COSHH report compiled by the manufacturer last updated on 14/06/2005
 9. Drug Company: Celgene. Date contacted: 03/08/2011

Version 3 (NHS Lothian local amendment)

Intravenous

MEDICINE NAME:

Levetiracetam

Levetiracetam

TRADE NAME(S):

Keppra®
levetiracetam (Sun Uk Ltd)

PRESENTATION OF MEDICINE:

Concentrate for solution for infusion, each 5mL vial contains 500mg of levetiracetam.⁽¹⁾
The concentrate is a clear, colourless solution.⁽¹⁾

METHOD OF ADMINISTRATION:

For infusion only - do not administer by IV injection.⁽¹⁾

Dilute the recommended dose in at least 100mL of suitable diluent and administer as a 15 minute IV infusion.^{(1)(2)(5)(6a)}

Dose	Withdrawal Volume	Volume of Diluent	Infusion Time	Frequency of administration	Total Daily Dose
250mg	2.5mL (half 5mL vial)	100mL	15 minutes	Twice daily	500mg/day
500mg	5mL (one 5mL vial)	100mL	15 minutes	Twice daily	1000mg/day
1000mg	10mL (two 5mL vials)	100mL	15 minutes	Twice daily	2000mg/day
1500mg	15mL (three 5mL vials)	100mL	15 minutes	Twice daily	3000mg/day

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Dilute required dose with a minimum of 100ml sodium chloride 0.9% or glucose 5%.⁽¹⁾ Discard if particulate matter or discolouration appears.^{(1)(2)(5)(6a)}

EXAMPLE CALCULATION:

All doses up to 2000mg to be given by infusion over at least 15 minutes.

STABILITY

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%⁽¹⁾

EXTRAVASATION:

Concentrate must always be diluted before administration: Concentrate has an extreme osmolarity and if extravasated is likely to cause tissue damage. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Glucose 5%, lactated Ringer's injection and sodium chloride 0.9% ⁽¹⁾

Incompatible: No information available ⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

None

SODIUM CONTENT (mmol):

0.833mmol per vial ⁽¹⁾

OSMOLARITY / OSMOLALITY:

3610mOsm/kg ⁽⁹⁾

pH:

pH 5.5 +/- 0.5 ⁽⁹⁾

REFERENCES:

1. Compendium of Data Sheets and Summaries of Product Characteristics
2. Martindale "The Complete Drug Reference"
3. American Hospital Formulary Service Drug Information"
4. Trissel "Handbook on injectable drugs"
5. British National Formulary 59
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2008
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name UCB Pharma:
Date contacted:14/01/09

Version 1 (NHS Lothian local amendment)

Intravenous

Levofloxacin

MEDICINE NAME:

Levofloxacin

TRADE NAME(S):

Tavanic®, Sanofi-Aventis

PRESENTATION OF MEDICINE:

Glass bottle containing 500mg of levofloxacin in 100mL as a clear greenish-yellow solution for infusion.⁽¹⁾⁽⁵⁾

METHOD OF ADMINISTRATION:

IV infusion: Administer by slow IV infusion via an infusion pump at a rate of not more than 250mg over 30 minutes or 500mg over at least 60 minutes.⁽¹⁾⁽⁵⁾ 750mg (unlicensed dose) should be administered over at least 90 minutes.⁽⁴⁾ Rapid infusion should be avoided because of the potential for hypotension.⁽⁴⁾

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹¹⁾ However, this is not requirement requested by the manufacturer.⁽⁹⁾ Alternatively, use a large peripheral vein after agreeing this route with a senior member of medical staff.

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

The expiry of infusion is 3 hours.⁽¹⁾

FLUSHING:

Sodium chloride 0.9%⁽¹⁾⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Tachycardia and transient hypotension, especially during rapid infusion. In rare cases, circulatory collapse may occur and the infusion must be stopped immediately. Hypersensitivity reactions (rash, pruritus, angioedema, anaphylactic shock), dyspnoea, bronchospasm, infusion site reactions and phlebitis.⁽¹⁾ Other adverse effects include; headache, dizziness, tremor and hypoglycaemia, especially in diabetics.⁽¹⁾ Monitor blood glucose and blood pressure.

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to low pH.⁽¹⁾⁽⁹⁾ If extravasation occurs refer to local treatment policies.⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible:

Levofloxacin is compatible with the following solutions for infusion: glucose 5%, sodium chloride 0.9%,⁽¹⁾ glucose 5% in sodium chloride 0.9%.⁽⁴⁾

Levofloxacin is compatible at the Y site with: amikacin, aminophylline, ampicillin, anidulafungin, bivalirudin, caffeine citrate, cefotaxime, cimetidine, clindamycin, daptomycin, dexamethasone sodium phosphate, dobutamine, dopamine, epinephrine, fentanyl, morphine sulphate, gentamicin, lidocaine, linezolid, metoclopramide, phenobarbital sodium, sodium bicarbonate, vancomycin.⁽⁴⁾

Incompatible:

aciclovir,⁽¹⁾ azithromycin,⁽⁴⁾ drotrecogin alfa, furosemide, heparin, propofol.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

No information is available.

SODIUM CONTENT (mmol):

154mmol of sodium per litre.⁽¹⁾⁽⁵⁾

OSMOLARITY / OSMOLALITY:

The infusion isotonic.⁽⁴⁾⁽⁹⁾

pH:

4.3 to 5.3 for the undiluted bottle,⁽⁹⁾

4.6 to 4.7 (5mg in 1mL) in glucose 5% or sodium chloride 0.9% solutions.⁽⁹⁾

OTHER COMMENTS:

1. Monitor renal function carefully, although rare levofloxacin can cause acute renal failure.⁽¹⁾ See the SPC for dose adjustments in renal impairment.
2. Caution is advised in patients with known risk factors for QT interval prolongation.⁽¹⁾
3. If diarrhoea is severe, persistent and or bloody during or after treatment may be symptomatic of Clostridium difficile-associated disease be indicative of enterocolitis, including pseudomembranous colitis.⁽¹⁾
4. Store at room temperature in the outer carton to protect product from light.⁽¹⁾⁽⁴⁾⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics eMC last revised May 2009
2. Martindale "The Complete Drug Reference", accessed via www.medicinescomplete.com, Aug 2010.
3. American Hospital Formulary Service Drug Information, accessed via www.medicinescomplete.com, Aug 2010.
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com, Aug 2010.
5. British National Formulary No.59, 2010

6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003
6a) British National Formulary for Children 2010-2011
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer: Sanofi-Aventis (not available)
9. Drug Company name: Sanofi-Aventis
Date contacted: August 2010
10. www.extravasation.org.uk
11. Royal College of Nursing Standards for Infusion Therapy 3rd Edition Jan 2010.

Version 2

Intravenous

Levomepromazine

MEDICINE NAME:

Levomepromazine
(methotrimeprazine)

TRADE NAME(S):

Nozinan® (Sanofi- Aventis)

PRESENTATION OF MEDICINE:

Ampoules containing levomepromazine 25mg in 1mL (as hydrochloride).⁽¹⁾

METHOD OF ADMINISTRATION:

ADULTS

Slow IV bolus injection: Give by slow IV injection over 3-5 minutes.⁽¹⁾⁽²⁾

CHILDREN

Continuous IV infusion: Administer over 24 hours.^{(2)(6a)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Dilute the required dose with equal volume of sodium chloride 0.9% immediately before IV injection.⁽¹⁾⁽⁴⁾ Sodium chloride 0.9% is the main diluent for most syringe pumps however water for injections has been used as a diluent for some combinations.⁽¹¹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours^{(2)(6a)}

FLUSHING:

Flush with sodium chloride 0.9%⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Postural hypotension (especially in the elderly), cardiac arrhythmias (rare), monitor blood pressure.⁽¹⁾

Somnolence and malaise, dizziness, disorientation, dry mouth occasional.⁽¹⁾

Allergic skin reactions, heat stroke in hot and humid conditions, photosensitivity.⁽¹⁾

EXTRAVASATION:

If extravasation occurs, refer to local treatment policies.⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible:

Alfentanyl.⁽¹²⁾ Diamorphine stable and compatible⁽¹⁾⁽¹²⁾ for up to 24 hours.⁽⁴⁾ Glycopyrronium,⁽¹²⁾ hydromorphone,⁽⁴⁾⁽¹²⁾ hyoscine butylbromide,⁽¹²⁾ hyoscine hydrobromide and midazolam in combination.⁽⁹⁾⁽¹²⁾ Morphine sulphate, morphine tartrate,⁽¹²⁾ oxycodone.⁽⁴⁾⁽¹²⁾ Y-Site compatibility includes fentanyl and methadone. Metoclopramide may be added to syringe pumps⁽⁴⁾⁽¹¹⁾ but combination is not generally recommended, e.g. seek specialist advice when combining multiple anti-emetics.

Incompatible:

Heparin sodium, ranitidine hydrochloride.⁽⁴⁾ Incompatibility may occur with dexamethasone, ketorolac, octreotide. Use with caution in syringe pumps, compatibility may depend on order of mixing or drug concentration, seek specialist advice.⁽¹²⁾

Levomepromazine injection is incompatible with alkaline solutions.⁽¹⁾⁽²⁾⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

No information available⁽⁸⁾

SODIUM CONTENT (mmol):

0.046mmol per ampoule⁽⁹⁾

3.7-4.7mmol as 25mg in 25mL sodium chloride 0.9%. See link⁽¹³⁾

OSMOLARITY / OSMOLALITY:

Solutions in sodium chloride 0.9% are isotonic.⁽⁴⁾⁽¹¹⁾

137mOsmol/L as the 25mg/mL ampoule⁽¹³⁾

301mOsmol/L as 25mg in 25mL sodium chloride 0.9% See link⁽¹³⁾.

pH:

3-5 as the 25mg/mL ampoule⁽²⁾⁽⁹⁾⁽⁴⁾

4.8 as 25mg in 25mL sodium chloride 0.9% See link⁽¹³⁾.

OTHER COMMENTS:

1. Dilutions in sodium chloride 0.9% stable for 24 hours.⁽¹⁾
2. Protect from light, discard if pink or yellow discolouration of solution.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Nozinan, last revised April 2010
2. Martindale "The Complete Drug Reference", accessed via www.medicinescomplete.com, Sept 2010.
3. American Hospital Formulary Service Drug Information, accessed via www.medicinescomplete.com, Sept 2010
4. Trissel "Handbook on injectable drugs", accessed via www.medicinescomplete.com, Sept

- 2010
5. British National Formulary No. 60, Sept 2010.
 6. Medicines for Children 2003
 - a) British National Formulary for Children 2010-11 accessed via www.bnfc.org.
 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
 8. COSHH report compiled by manufacturer
 9. Drug company name: Sanofi-Aventis
Date contacted: September 2010
 10. National Extravasation Service www.extravasation.org.uk
 11. Palliative Medicines Handbook, accessed via <http://book.pallcare.info/>, Sept 2010.
 12. Palliative Drugs, accessed via www.palliativedrugs.com, Sept 2010.
 13. Quality Assurance Department, Charing Cross Hospital, October 2010

Version 5

Intravenous

Linezolid

MEDICINE NAME:

Linezolid

TRADE NAME(S):

Zyvox®

PRESENTATION OF MEDICINE:

Infusion bags containing linezolid 600mg in 300mL ⁽¹⁾

METHOD OF ADMINISTRATION:

IV Infusion: Administer over a period of 30 to 120 minutes using an infusion pump. ⁽¹⁾

Stability

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%. ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Injection site pain, phlebitis and thrombophlebitis, anaphylaxis. ⁽¹⁾⁽⁹⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to low pH. If extravasation occurs refer to local treatment policies. ⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

The manufacturer recommends that additives should not be introduced into the linezolid infusion bag and that linezolid should be administered separately with flushing before and after administration. ⁽¹⁾

Incompatible: Physically incompatible with amphotericin, chlorpromazine hydrochloride, diazepam, pentamidine isethionate, erythromycin lactobionate, phenytoin sodium and sulphamethoxazole/trimethoprim. Chemically incompatible with ceftriaxone sodium. ⁽¹⁾

SODIUM CONTENT (mmol):

1.67mmols sodium in 100mL. ⁽¹⁾

OSMOLARITY / OSMOLALITY:

290mOsmol/L. ⁽⁹⁾

pH:

pH 4.8 (Range 4.4 to 5.2). ⁽⁹⁾

OTHER COMMENTS:

1. Each 1mL of the solution contains 45.7mg glucose (i.e. 13.7g in 300mL). This should be taken into account in patients with diabetes mellitus or other conditions associated with glucose intolerance.⁽¹⁾
2. Linezolid ready-to-use solutions may exhibit a yellow colour that can intensify over time without affecting the stability of the drug.⁽⁴⁾
3. For single use only. Intact containers should be kept in their protective overwrap until ready to use. Check for minute leaks by squeezing the bag firmly. If the bag leaks do not use as sterility may be impaired.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Zyvox®, Pharmacia Ltd. Date of revision of text 09/11/2011
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com on 30/02/2012
3. American Hospital Formulary Service Drug Information" accessed via www.medicinescomplete.com on 30/03/2012
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com on 30/03/2012
5. British National Formulary No 63 March 2012 accessed via www.bnf.org/bnf/ on 30/03/2012
6. Royal College of Paediatrics and Child Health "Medicines for Children"2003
 - a) British National Formulary for Children 2011-2012 accessed via www.bnf.org/bnfc/ on 30/03/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer. Version 2.1 revised 24/10/2011
9. Drug company name: Pharmacia. Date contacted: 12/04/2012 (personal communication)
10. Patient Information Leaflet, Zyvox®, Pharmacia, accessed 30/03/2012
11. National Extravasation Service, www.extravasation.org.uk, accessed on 30/03/2012

Version 1 (NHS Lothian local amendment)

Intravenous

Liothyronine sodium

MEDICINE NAME:

Liothyronine sodium
(L-Tri-iodothyronine)

TRADE NAME(S):

PRESENTATION OF MEDICINE:

Vials containing liothyronine sodium 20micrograms powder for reconstitution ⁽¹⁾

METHOD OF ADMINISTRATION (adult):

IV injection: Give by slow IV injection. ⁽¹⁾

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a high pH. If a central venous access device is unavailable, a risk benefit analysis should be made on an individual patient basis. ⁽¹¹⁾

INSTRUCTIONS FOR RECONSTITUTION (adult):

Add 1mL or 2mL of water for injections (WFI) to the vial, and shake gently until the solution has dissolved. ⁽¹⁾

DISPLACEMENT VALUE:

No information. ⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

May be further diluted to 10mL with water for injections. ⁽¹⁰⁾

FLUSHING:

Flush with sodium chloride 0.9%. ⁽¹⁰⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Arrhythmias, tachycardia, palpitations, muscle cramps and angina (usually reflective of excessive dose). ⁽¹⁾

Monitoring: pulse and ECG. ⁽¹⁰⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to high pH.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion. Flush the line both before and after giving the injection.

SODIUM CONTENT (mmol):

Negligible. ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information.⁽⁹⁾

pH:

8.5 to 11.5.⁽⁹⁾

OTHER COMMENTS:

1. Do not store above 25°C. Protect from light.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Liothyronine sodium 20micrograms injection, Mercury Pharmaceuticals (Supplier Amdipharm Mercury Company Ltd), last revised 23/10/2012
2. Martindale accessed via <http://www.medicinescomplete.com>. Date accessed 03/06/2013
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 03/06/2013
4. Trissel "Handbook on injectable drugs"
5. British National Formulary No. 65 March 2013 page 460
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by manufacturer - not available
9. Drug company name: Amdipharm Mercury Company Ltd. Date contacted: 03/06/2013
10. Injectable Drug Administration Guide, UCLH. Third Edition 2010, pg 225
11. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 4

Intravenous

Lorazepam

MEDICINE NAME:

Lorazepam

TRADE NAME(S):

Ativan®

PRESENTATION OF MEDICINE:

Ampoules containing lorazepam 4mg in 1mL ⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: Administer slowly.

Adults: Give by slow IV injection into a large vein at a maximum rate of 2mg per minute⁽²⁾⁽⁵⁾ except in the control of status epilepticus where rapid injection is required.⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Already in solution but may require further dilution to facilitate injection.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Adults and children: Dilute 1 part lorazepam with 1 part sodium chloride 0.9%⁽¹⁾ immediately before administration.

Neonates: Dilute to 100micrograms in 1mL with sodium chloride 0.9%.^(6a)

STABILITY

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9% ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Monitor blood pressure and respiratory rate.⁽³⁾
2. Severe anaphylactic/anaphylactoid reactions have been reported with the use of benzodiazepines.⁽¹⁾
3. Respiratory depression/arrest and hypotension may occur.⁽¹⁾ Facilities and equipment necessary to maintain a patent airway and to support respiration/ventilation should be readily available.⁽¹⁾
4. Administer with caution to patients in whom a drop in blood pressure might lead to cardiovascular or cerebrovascular complications.⁽¹⁾ This is particularly important in the elderly.⁽¹⁾
5. It is recommended that patients should remain under observation for at least eight hours and preferably overnight. When used for short procedures on an outpatient basis, the patient should be accompanied when discharged.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

When giving by IV injection do not administer via an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.⁽¹⁰⁾

The manufacturer lists water for injections as a suitable diluent for preparing an infusion: use of water for injections is not generally recommended as its use is likely to cause hyponatraemia.⁽¹⁰⁾

SPECIAL HANDLING PRECAUTIONS:

Unnecessary contact with skin, mucous membranes or eyes or inhalation of the product should be avoided.⁽⁹⁾

SODIUM CONTENT (mmol):

No sodium in the product ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information available ⁽⁹⁾

pH:

No information available ⁽⁹⁾

OTHER COMMENTS:

1. Store in fridge and transport refrigerated.⁽¹⁾ May only be taken out of fridge immediately prior to administration for a maximum of 30 minutes. **Do not use if out of fridge for longer than 30 minutes.** ⁽⁹⁾ **N.B. This may cause problems with the transporting of lorazepam from pharmacy to the wards.**
2. Should not be administered into small veins⁽¹⁾ or administered by intra-arterial injection since arteriospasm can occur.⁽³⁾

REFERENCES:

1. Summary of Product Characteristics, Ativan®, last updated 22/08/2011
2. Martindale "The Complete Drug Reference" 37th Edition accessed via <http://www.medicinescomplete.com> on 16/12/2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 16/12/2011
4. Trissel "Handbook on injectable drugs" 16th Edition accessed via <http://www.medicinescomplete.com> on 16/12/2011
5. British National Formulary No. 63, March 2012, pg 223, 309, 824
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012, page 234
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December](#)

[2011](#)

8. COSHH report compiled by manufacturer
9. Drug company name: Pfizer Ltd
Date contacted: 16/11/2011
10. Guidelines for writing and updating monographs for the Injectable Medicines Guide website,
December 2011

Version 4 (NHS Lothian local amendment)

Intravenous

Magnesium sulphate

WARNING: Magnesium sulphate 50% must ALWAYS be diluted before use.
NHS Lothian Local IV Monograph

For treatment of eclampsia and foetal neuroprotection in pre-term birth see Reproductive Medicine Policies.

For Oncology patients see Edinburgh Cancer Centre Guidelines.

For Acute Emergencies requiring magnesium sulphate see NHS Lothian Adult Medical Emergency Handbook.

All available on the NHS Lothian Intranet.

MEDICINE NAME:

Magnesium sulphate

TRADE NAME(S):

Non proprietary available from Martindale Pharma
Auden McKenzie (Pharma Division) Ltd
Torbay Pharmacy Manufacturing Unit
UCB Pharma Ltd

PRESENTATION OF MEDICINE:

PRODUCTS WHICH REQUIRE DILUTION BEFORE ADMINISTRATION:

Magnesium sulphate 50% solution

Ampoules containing magnesium sulphate

- 1g in 2mL (4mmol magnesium in 2mL)^(1a-b)
- 2.5g in 5mL (10mmol magnesium in 5mL)^(1a)
- 5g in 10mL (20mmol magnesium in 10mL)^(1a-c)
- 10g in 20mL (40mmol magnesium in 20mL)^(1c)
- 25g in 50mL (100mmol in 50mL)^(1c)

Pre-filled syringes containing magnesium sulphate 2g in 4mL (8mmol magnesium in 4mL).^(1e)

METHOD OF ADMINISTRATION:

IV injection:

Give magnesium sulphate 10% solution by slow IV injection. In adults administer at a rate of no more than 1.5mL (0.6mmol) per minute.⁽⁴⁾

IV Infusion:

For treatment of hypomagnesaemia in adults: Give at a rate not greater than 1.5mL/minute using a 10% solution or 3mL/minute using a 5% solution.⁽³⁾⁽⁵⁾

Preferably administer concentrations of 5% and above via a central venous access device to avoid potential venous irritation as the preparation has a high osmolarity.⁽¹²⁾

If infusion via a peripheral cannula is required it is recommended to dilute to a concentration of less than 5%.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

To prepare magnesium sulphate 10% (i.e. 20mmol magnesium in 50mL)

Dilute 10mL of magnesium sulphate 50% to 50mL with sodium chloride 0.9% or glucose 5%.

To prepare magnesium sulphate 5% (i.e. 20mmol magnesium in 100mL) :

Dilute 10mL of magnesium sulphate 50% injection to 100mL with sodium chloride 0.9% or glucose 5%.

For peripheral cannula administration it may be preferable to dilute the magnesium chloride 50% with an equal volume of sodium chloride 0.9% or glucose 5% before administration.

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours

FLUSHING:

IV injection or infusion: Flush with sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Possible side effects (due to hypermagnesaemia) include flushing, thirst, nausea and vomiting, depression of reflexes, drowsiness, hypotension, bradycardia, cardiac arrhythmias, respiratory depression and coma.^{(1a-e)(3)}

Hypocalcaemia may occur.^(1d)

Monitor blood pressure, respiratory rate, heart rate, magnesium, calcium and other electrolyte plasma levels, fluid balance and ECG.^{(1d)(2)}

Magnesium levels should be measured 1-2 hours after the end of the infusion.

EXTRAVASATION:

Extravasation of concentrations of magnesium sulphate of 10% and above is likely to cause tissue damage due to high osmolarity. Administer via a central venous access device if possible. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):⁽¹⁾⁽⁴⁾

Aciclovir, amikacin, cisatracurium, clonidine, erythromycin, esmolol, gentamicin, heparin, insulin (soluble), labetalol, metronidazole, milrinone, morphine sulphate, potassium chloride infusion, propofol, remifentanyl, vancomycin

Other compatible infusion fluids: Glucose 10%, sodium lactate infusion, compound (Hartmann's), sodium chloride 0.45% and glucose and sodium chloride combinations.^(6a)

Incompatible:⁽¹⁾⁽⁴⁾ Amiodarone, amphotericin, calcium salts, ciprofloxacin, clindamycin, dobutamine, phosphates preparations and sodium bicarbonate.

SODIUM CONTENT (mmol):

50% injections:

Excipients include sodium hydroxide. Small amounts may be added during the manufacturing process to adjust the pH.^(9b) However, the amount is variable between batches.^(9a-c)

N.B. Ready diluted preparations may be prepared in sodium chloride 0.9%.

OSMOLARITY / OSMOLALITY:

50% injections: No information available from the manufacturers^(9a-c) The 50% solution has a calculated osmolality of 4060mOsm/L⁽⁴⁾

pH:

10% and 50% injections: 5.5 to 7.^{(4)(9a-c)}

OTHER COMMENTS:

1. Magnesium sulphate 1g is equivalent to approximately 4mmol magnesium (Mg^{2+}).⁽⁵⁾
2. Magnesium sulphate must be used with caution in patients suspected of or known to have renal impairment.^(1a-e)
3. Do not store above 25°C.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Magnesium Sulphate injection BP 50%, Aurum (Martindale Pharma), last revised 15/05/2008
 - b) Magnesium Sulphate injection BP 50%, Auden McKenzie, last revised 28/08/2009
 - c) Magnesium Sulphate injection BP 50%, South Devon Healthcare, last revised June 1999
 - d) Magnesium sulphate injection 50%, UCB Pharma Ltd, last revised September 2010
 - e) Magnesium Sulphate injection BP Minijet 50%, International Medication Systems (UCB Pharma Ltd), last updated November 2005
2. Martindale accessed via www.medicinescomplete.com on 04/05/2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 04/05/2012
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com on 04/05/2012
5. British National Formulary No 62, accessed via www.bnf.org on 04/05/2012
6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003
 - a) British National Formulary for Children 2011-12 accessed via www.bnf.or/bnfc on 04/05/2012
7. Medical Devices Agency device bulletin "Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)"

8. COSHH report compiled by the manufacturer
9. a) Drug Company name: Martindale Pharma. Date contacted: 04/05/2012
b) Drug company name: Auden McKenzie. Date contacted: 04/05/2012
c) Drug company name: UCB Pharma. Date contacted: 04/05/2012
10. Towards standardisation of drug infusion concentrations in UK critical care units Borthwick et al, Journal of the Intensive Care Society, Volume 10, Number 3, July 2009
11. Standard concentrations for infusions used in critical care areas. The Intensive Care Society website (2010) [See Link](#)
12. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 3 (NHS Lothian local amendment)

Intravenous

Meropenem

Contains a PENICILLIN-like structure

MEDICINE NAME:

Meropenem

TRADE NAME(S):

Meropenem® (AstraZeneca)
Generic (Hospira, Sandoz)

PRESENTATION OF MEDICINE:

Vials containing meropenem 500mg, 1g powder for reconstitution (as trihydrate).^(1a-e)

METHOD OF ADMINISTRATION:

IV infusion is preferred for doses over 1g (adults) or 20mg/kg (children); there are limited safety data available to support the administration of a 2g dose (adults) or 40mg/kg (children) as an intravenous injection.^(1a-e)

IV injection: Give by slow IV injection over 5 minutes.^(1a-e)

IV infusion (preferred): Infuse over approximately 15 to 30 minutes.^(1a-e)

INSTRUCTIONS FOR RECONSTITUTION:

IV injection: Reconstitute with water for injections;^(1a-e) use 10mL water for injections for every 500mg of meropenem to give a concentration of 50mg in 1mL.^{(1b-e)(4)(10)}

IV infusion: May be directly reconstituted with sodium chloride 0.9% or glucose 5% then diluted further for infusion (see below).^{(1a-e)(9a)}

Shake the reconstituted solution before use;^(1a-e) reconstituted solutions are clear, and colourless to yellow.^{(1b-e)(4)}

DISPLACEMENT VALUE:

0.4mL for 500mg and 0.9mL for 1g of meropenem (Meropenem®).^(9a)

0.42mL for 500mg and 0.95mL for 1g of meropenem (Hospira).^(9b)

0.5mL for 500mg and 1mL for 1g meropenem (Sandoz).^(9c)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

For IV infusion the reconstituted solution may be further diluted with sodium chloride 0.9% or glucose 5%.^(1a-e) Diluent volumes of 50-200mL are suitable for adult doses.^{(1d-e)(5)}

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

Solutions for injection or infusion prepared in clinical areas should be used immediately; the time interval between reconstitution and the end of intravenous injection or infusion should not exceed one hour.^(1a-e)

FLUSHING:

Sodium chloride 0.9% or glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Local site reactions, inflammation, thrombophlebitis, pain at injection site, rash, pruritus, urticaria, systemic allergic reactions, angioedema, convulsions.^(1a-e) Apnoea also reported.⁽³⁾

Discontinue immediately at the first appearance of rash or other signs of hypersensitivity, and administer appropriate treatment.^(1a-e)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

(It is assumed that medicines meet close to the vascular access device)

When giving by **IV injection** do not administer via an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection

Compatible at Y-site: (meropenem in sodium chloride 0.9% diluent) aminophylline, dexamethasone, digoxin, fluconazole, furosemide, gentamicin, heparin, insulin human soluble, metoclopramide, morphine, potassium chloride, vancomycin.⁽⁴⁾

Incompatible: Aciclovir, amphotericin, calcium gluconate, diazepam, doxycycline, ondansetron, pantoprazole, zidovudine.⁽⁴⁾

SODIUM CONTENT (mmol):

Each 500mg vial contains approximately 2mmols of sodium.^{(1a)(1b)(1d)}

Each 1g vial contains approximately 4mmols of sodium.^{(1a)(1c)(1e)}

OSMOLARITY / OSMOLALITY:

When reconstituted with water for injections to a concentration of 50mg in 1mL

365mOsmol/kg (Meronem®).^(9a)

420 to 471mOsmol/kg (Hospira).^(9b)

pH:

7.3 to 8.3 after reconstitution.^{(4)(9a-b)}

OTHER COMMENTS:

1. The product and packaging do not contain latex, however the product is manufactured in units where staff wear latex gloves, therefore the vial and outer packaging may have come into contact with latex during some part of the manufacturing process. (Meronem® and Hospira products).^(9a-b)
2. Do not store vials above 30°C;^(1a) do not freeze the reconstituted solution.^(1a-e)
3. Excipients: anhydrous sodium carbonate.^(1a-e)
4. Vials are for single use only.^(1a-e)

REFERENCES:

1. Summary of Product Characteristics
 - a) Meronem® (AstraZeneca UK Ltd). Last revised 08/06/2010
 - b) Meropenem 500mg (Hospira UK Ltd). Last revised 24/08/2010
 - c) Meropenem 1g (Hospira UK Ltd). Last revised 24/08/2010
 - d) Meropenem 500mg (Sandoz Ltd). Last revised 05/08/2010
 - e) Meropenem 1g (Sandoz Ltd). Last revised 05/08/2010
2. Martindale accessed via <http://www.medicinescomplete.com> on 12/08/2010
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 12/08/2010
4. Trissel "Handbook on Injectable Drugs" 2009 accessed via <http://www.medicinescomplete.com> on 12/08/2010
5. British National Formulary No. 59 accessed via <http://www.bnf.org> on 12/08/2010
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2010-11 accessed via <http://www.bnf.org/bnfc> on 12/08/2010
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
 - a) AstraZeneca UK Ltd. Date of preparation 23/02/2007
 - b) Hospira UK Ltd. Date of preparation 03/09/2010
9.
 - a) Drug company name: AstraZeneca UK Ltd. Date contacted: 24/11/2009; 04/02/2010; 02/08/2010
 - b) Drug company name: Hospira UK Ltd. Date contacted: 10/01/2011; 12/01/2011; 13/01/2011
 - c) Drug company name: Sandoz Ltd. Date contacted: 10/01/2011; 03/02/2011
10. Patient Information Leaflet for Meronem®. Last revised October 2009

Version 2

Intravenous

Mesna

MEDICINE NAME:

Mesna

TRADE NAME(S):

Mesna (Baxter)

PRESENTATION OF MEDICINE:

Ampoules containing mesna 400mg in 4mL solution for infusion

Ampoules containing mesna 1000mg in 10mL solution for infusion.⁽¹⁾⁽⁵⁾

METHOD OF ADMINISTRATION:

IV infusion: Give over 15 to 30 minutes.⁽¹⁾

Continuous IV infusion: Give over 12 or 24 hours. The method of administration depends on the patient's chemotherapy regimen.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Sodium chloride 0.9% and glucose 5%.⁽⁴⁾

Dilute to a convenient volume with sodium chloride 0.9% or glucose 5%, e.g. 100mL.⁽⁴⁾

STABILITY

Prepare immediately before use. Use within 24 hours.⁽⁴⁾

FLUSHING:

Sodium chloride 0.9% or glucose 5%⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Anaphylactic reaction or pseudoallergic reactions (rash, pruritus, blistering of the skin and mucous membranes, urticarial oedema, sudden hypotension, tachycardia and transient rise of liver transaminases), especially in patients with autoimmune disorders.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Granisetron,⁽⁴⁾ ondansetron.⁽⁴⁾

Incompatible: Amphotericin.⁽⁴⁾

Compatible with the following diluents in addition to those listed above:

Sodium chloride 0.45%/glucose 5%, compound sodium lactate (Hartmann's).⁽⁴⁾

Mesna can be mixed in the same infusion bag as ifosfamide.⁽¹⁾

SODIUM CONTENT (mmol):

2.1mmol sodium per 400mg ampoule.⁽⁹⁾
5.3mmol sodium per 1000mg ampoule.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

1242mOsmol/L (undiluted).⁽⁹⁾

pH:

pH 7.5 to 8.5 ⁽⁴⁾⁽⁸⁾

OTHER COMMENTS:

1. Store below 30°C.⁽¹⁾
2. Protect ampoules from light.⁽¹⁾
3. Mesna may cause a false positive for ketones in urine. Colour reaction for ketones is reddish purple rather than purple.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics. Date of revision of text 06/04/2009
2. Martindale "The Complete Drug Reference" 36th Edition 2009
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 14/09/2011
4. Trissel "Handbook on injectable drugs" 15th Edition accessed via <http://www.medicinescomplete.com> on 14/09/2011
5. British National Formulary No. 61 March 2011
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2007
a) British National Formulary for Children 2010-11
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer. Material Safety Data Sheet, Mesna Injection. Baxter Healthcare. Revised 11/05/2008
9. Drug company name: Baxter
Date contacted: 18/11/2010

Version 4 (NHS Lothian local amendment)

Intravenous

Methylprednisolone (as sodium succinate)

Caution: There are TWO different formulations of methylprednisolone injection available (methylprednisolone succinate and methylprednisolone acetate).

NEVER administer methylprednisolone ACETATE (Depo-Medrone) INTRAVENOUSLY

MEDICINE NAME:

Methylprednisolone (as sodium succinate)

TRADE NAME(S):

Solu-Medrone ®

PRESENTATION OF MEDICINE:

40mg, 125mg, 500mg, 1g, 2g all vials containing powder for reconstitution. All provided with solvent (water for injections) for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION:

Adults

IV injection: (doses up to 250mg) over a period of at least 5 minutes.⁽¹⁾⁽²⁾⁽⁵⁾

IV infusion: (doses over 250mg) over at least 30 minutes.⁽¹⁾⁽²⁾⁽⁵⁾

For treatment of acute spinal cord injury see 'comments' section.

Children

All doses for children should be given over 30 minutes.^{(6)(6a)}

INSTRUCTIONS FOR RECONSTITUTION:

Use solvent provided for reconstitution ⁽¹⁾

DISPLACEMENT VALUE:

40mg vial = 0.046mL (i.e. after adding the 1mL solvent provided, the final volume = 1.046mL) ⁽⁹⁾

125mg vial = 0.143mL (i.e. after adding the 2mL solvent provided, the final volume = 2.143mL) ⁽⁹⁾

500mg vial = 0.57mL (i.e. after adding the 7.8mL solvent provided, the final volume = 8.37mL) ⁽⁹⁾

1g vial = 1.14mL (i.e. after adding the 15.6mL solvent provided, the final volume = 16.74mL) ⁽⁹⁾

2g vial = 2.29mL (i.e. after adding the 31.2mL solvent provided, the final volume = 33.49mL) ⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

For IV infusion, further dilution is required before administration. Use glucose 5% or sodium chloride 0.9%.⁽¹⁾ Dilute to any suitable volume (e.g. 50 - 250mL), so long as doses are infused over at least 30 minutes ⁽⁹⁾

Children

Doses for children may be diluted in sodium chloride 0.9% or 0.45% or glucose 5% or 10%.^(6a)

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

Do not use any prepared infusion more than 24 hours after preparation. ⁽⁴⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5% ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Possible acute adverse effects include anaphylactic reaction with or without circulatory collapse, cardiac arrest, bronchospasm, cardiac arrhythmias and hypertension or hypotension ⁽¹⁾. Monitor blood pressure and pulse during administration. ⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Aciclovir, dopamine, heparin, linezolid, metronidazole, midazolam, morphine sulphate, remifentanyl ⁽⁴⁾

Incompatible:

Ciprofloxacin, cisatracurium, potassium chloride, propofol ⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

None ⁽⁹⁾

SODIUM CONTENT (mmol):

40mg vial contains 0.36mmol sodium. ⁽⁹⁾

125mg vial contains 0.5mmol sodium. ⁽⁹⁾

500mg vial contains 2.43mmol sodium. ⁽⁹⁾

1g vial contains 4.85mmol sodium. ⁽⁹⁾

2g vial contains 9.7mmol sodium. ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

When reconstituted with the volume of solvent supplied with the vial

40mg in 1mL solution = 500mOsm/L

62.5mg per 1mL solution = 400mOsm/L ⁽⁴⁾⁽⁹⁾.

pH:

pH 7 to 8 ⁽⁴⁾⁽⁹⁾

OTHER COMMENTS:

1. For the treatment of acute spinal cord injury give 30mg/kg methylprednisolone intravenously over 15 minutes, followed by a 45 minute pause and then a continuous infusion of 5.4mg/kg/hour for 23 hours. Begin treatment within 8 hours of injury (information taken from

SPC for 2g vial). ⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics. Solu Medrone 2g vial. Last updated April 2008. SPC for the other strength vials last updated July 2008
2. Martindale "The Complete Drug Reference" 35th Edition, pg 1387
3. American Hospital Formulary Service Drug Information 2006, pg 3004
4. Trissel "Handbook on injectable drugs" 14th Edition, pg 1097
5. British National Formulary No. 58 pg 399 and 875
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2009 pg 452
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug Company name: Pfizer
Date contacted: February 2010
10. Local practice at Derriford Hospital, Plymouth

Version 6 (NHS Lothian local amendment)

Intravenous

Methylthioninium chloride (methylene blue)

Feb 2012: Methylene Blue Injection USP 1% w/v was previously the only product available in the UK. ⁽¹³⁾ N.B. This is a different strength to the Proveblue product (0.5% w/v) which is now available.⁽¹⁾

MEDICINE NAME:

Methylthioninium chloride

TRADE NAME(S):

Methylthioninium chloride (Proveblue) (Martindale)

PRESENTATION OF MEDICINE:

Vial containing 50mg methylthioninium chloride in 10mL (0.5%w/v)⁽¹⁾

METHOD OF ADMINISTRATION:

Due to extreme pH administer if possible, via a central venous access device.⁽¹²⁾

Administer very slowly over a minimum of 5 minutes.⁽¹⁾ Methylthioninium chloride is hypotonic; dilution with 50mL glucose 5% may help to avoid local pain, in particular in paediatric patients.⁽¹⁾ Do not use methylthioninium chloride solutions if the solution is discoloured, cloudy, turbid or a precipitate or particles are present.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Dose required can be diluted with 50mL glucose 5%.⁽¹⁾

FLUSHING:

Flush with glucose 5%.⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Nausea, abdominal and chest pain, dizziness, headache, profuse sweating, mental confusion, hypotension, hypertension, cardiac arrhythmias.⁽¹⁾
Blue discolouration of urine, stools and saliva.⁽¹⁾

The MHRA have issued the following advice on use of methylthioninium chloride:-⁽¹⁴⁾

- Methylthioninium chloride by the intravenous route is approved only for drug-induced methaemoglobinaemia in adults at a dose of 1–2mg/kg
- Off-label use of methylthioninium (including use in parathyroid localisation or its use at doses exceeding the licensed dose) should be carefully evaluated in view of the potential for CNS toxicity
- Intravenous methylthioninium chloride should be avoided in patients who have been treated recently with serotonergic antidepressants, including SSRIs, clomipramine, and venlafaxine
- If use of intravenous methylthioninium chloride cannot be avoided, the lowest possible dose should be used and the patient observed closely for CNS effects for up to four hours after administration

- If features of CNS toxicity develop after use of methylthioninium, the patient should be monitored closely and given supportive care

EXTRAVASATION:

Tissue damage likely due to low pH ⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not inject or infuse this medicine via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

Incompatible: Sodium chloride 0.9% ⁽¹⁾

SODIUM CONTENT (mmol):

Nil ⁽²⁾

OSMOLARITY / OSMOLALITY:

Between 10 and 15 mOsm/Kg ⁽¹⁾

pH:

3 to 4.5 ⁽¹⁾

OTHER COMMENTS:

1. Do not administer by intra-spinal injection or subcutaneous injection. ⁽¹⁾
2. Use immediately on opening. ⁽¹⁾
3. Store below 25°C. Do not freeze or refrigerate. ⁽¹⁾
4. Keep ampoules in original package to protect from light. ⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Methylthioninium chloride (Proveblue) injection. Provepharm SAS (distributed by Martindale Pharmaceuticals Ltd) last updated October 2011
2. Martindale "The Complete Drug Reference" 36th Edition 2009 page 1450
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 06/07/2010
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 06/07/2010
5. British National Formulary No. 59, March 2010
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer - not available
9. Drug company name: Martindale Pharma, Date contacted: 06/07/2010; February 2012

10. Beritz WE & Tatro DS: The Pediatric Drug Handbook, 3rd Mosby-Year Book, Inc, St Louis, MO 1995 (Micromedex accessed 05/07/2010)
11. www.extravasation.org.uk accessed 06/07/2010
12. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
13. SPC Methylene blue USP 1%injection [See Link](#)
14. MHRA Drug Safety Update Volume 2, Issue 9 April 2009 Latest advice for medicines users
Methylthioninium chloride (methylene blue): Update on CNS toxicity with serotonergic drugs.
[See Link](#)

Version 2

Intravenous

Metoclopramide hydrochloride

August 2013: Changes recommended by MHRA⁽¹⁰⁾ will not necessarily be reflected in manufacturers SPC and package insert.

MEDICINE NAME:

Metoclopramide hydrochloride

TRADE NAME(S):

Maxolon®, Metoclopramide (Ennogen, hameln, Mercury)
Maxolon High Dose®

PRESENTATION OF MEDICINE:

Ampoules containing metoclopramide hydrochloride 10mg in 2mL ^{(1a)(1c-e)}

Ampoules containing metoclopramide hydrochloride 100mg in 20mL ^(1b)

METHOD OF ADMINISTRATION (adult):

Standard dose ampoules (10mg in 2mL):

IV injection: Give by slow IV injection over at least 3 minutes. ⁽¹⁰⁾

High dose ampoules (100mg in 20mL) for cytotoxic chemotherapy only:

Do not administer by IV injection

Continuous Infusion: (preferred method) Give a loading dose diluted in 50-100mL over 15-20 minutes prior to chemotherapy, followed by a maintenance dose diluted in 500mL over 8-12 hours. Give via an infusion pump. ^{(1b)(1c)}

Intermittent IV infusion: Dilute in at least 50mL and give over 15-20 minutes. ^{(1b)(1c)(1e)(5)}

Metoclopramide should only be prescribed for short-term use (up to 5 days). ⁽¹⁰⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

Dilute with sodium chloride 0.9% or glucose 5% ^{(1b-c)(1e)}

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

24 hours. ^{(1b)(1e)(4)}

FLUSHING:

Flush with sodium chloride 0.9%. ⁽⁴⁾⁽⁵⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Drowsiness, restlessness, confusion, dystonic reactions particularly in children and young adults, abnormalities of cardiac conduction, hypersensitivity reactions, anaphylaxis, ^(1a-e) injection site inflammation, local phlebitis. ^(1c)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusions (it is assumed that medicines meet close to the vascular access device): Aciclovir sodium, ciprofloxacin, cisatracurium besylate, clarithromycin, dexmedetomidine hydrochloride, doxapram hydrochloride, fentanyl citrate, filgrastim, fluconazole, granisetron hydrochloride, heparin sodium, levofloxacin, linezolid, meropenem,

morphine sulfate, ondansetron hydrochloride, piperacillin sodium-tazobactam sodium, remifentanyl hydrochloride.⁽⁴⁾

Compatible infusion fluids: Sodium lactate, compound (Hartmann's),^{(1b-c)(3)(4)} glucose 5% in sodium chloride 0.45%,⁽³⁾⁽⁴⁾ sodium chloride 0.18% plus glucose 4%.^{(1b-c)(1e)}

Incompatible: Allopurinol, amsacrine, doxorubicin hydrochloride liposomal injection, furosemide, propofol.⁽⁴⁾

The following are usually incompatible, infuse separately if possible. Parenteral nutrition solutions, sodium bicarbonate infusions, phosphate preparations, blood components, plasma substitutes.

SODIUM CONTENT (mmol):

2.74mmol of sodium in 20mL vial.^(9a)
Negligible sodium per 2mL vial.^{(9a)(9c-e)}

OSMOLARITY / OSMOLALITY:

270-310mOsmol/kg (hameln).^(9b)
292.5mOsmol/L (Ennogen).^(9d)
No information available for Amdipharm and Mercury preparations.^{(9a)(9c)}

pH:

Maxolon High Dose[®]: pH 5 to 6.5.^(9a)
Metoclopramide 10mg in 2mL preparations: pH 3 to 5.^(9a-d)
For further information please see link below.

OTHER COMMENTS:

1. Protect metoclopramide ampoules from light. Ampoules removed from their carton should be stored away from light.^(1a-e) If inadvertent exposure occurs, ampoules showing discolouration must be discarded.^(1a-b)
2. Protect diluted solutions from light during infusion. Degradation is indicated by a yellow discolouration. Such solution must not be used.^(1c)

REFERENCES:

1. Summary of Product Characteristics
 - a) Maxolon Injection, Amdipharm, text last revised 31/01/2011
 - b) Maxolon High Dose, Amdipharm, text last revised 31/01/2011
 - c) Metoclopramide, hameln, text last revised December 2011
 - d) Metoclopramide, Mercury Pharma, text last revised 05/08/2011
 - e) Metoclopramide, Ennogen, text last revised 16/03/2012
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com on 13/10/2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 31/10/2012
4. Trissel "Handbook of Injectable Drugs" accessed via www.medicinescomplete.com on 07/11/2012
5. British National Formulary No. 64, September 2012, pg 259-260 and 990
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003

- a) British National Formulary for Children 2012-2013, page 198-199
- 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
- 8. COSHH report compiled by the manufacturer.
- 9. a) Drug company name: Amdipharm plc. Date contacted: 02/11/2012
 - b) Drug company name: hameln. Date contacted: 31/10/2012
 - c) Drug company name: Mercury Pharma. Date contacted: 01/11/2012
 - d) Drug company name: Ennogen. Date contacted: 31/10/2012
- 10. MHRA Drug Safety update, volume 7, Issue 1 August 2013. Metoclopramide: risk of neurological adverse effects—restricted dose and duration of use

Version 6

Intravenous

Metronidazole

MEDICINE NAME:

Metronidazole

TRADE NAME(S):

Flagyl®, Generic (Braun, Baxter)

PRESENTATION OF MEDICINE:

Flagyl glass bottle containing 500mg metronidazole in 100mL Solution for Infusion.^(1a)

Flagyl Viaflex minibag or Viaflex mini-bag plus containing 500mg metronidazole in 100mL Solution for Infusion.^(1a)

Ecoflec plus® bottles of low density polyethylene containing 500mg metronidazole in 100mL Solution for Infusion.^(1b)

Viaflo® bag composed of polyolefin/polyamide plastic containing 500mg metronidazole in 100mL Solution for Infusion.^(1c)

METHOD OF ADMINISTRATION:

IV infusion:

Adults: Administer at a rate of 5mL/minute (25mg/minute) which is 500mg in 100mL over a minimum of 20 minutes.^{(1a-c)(10)}

Infusion bag is already diluted.^{(1a-c)(10)}

Children: Administer calculated dose over 20-30 minutes.^(6a)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Infusion bag is provided already diluted.⁽¹⁾

FLUSHING:

IV infusion: Flush with sodium chloride 0.9% or glucose 5% ⁽⁹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

Anaphylaxis, erythema, urticaria,^(1a-c) angiodema, pruritis, ^(1a-b) thrombophlebitis,⁽²⁾ nausea and vomiting, metallic taste in the mouth.⁽¹⁰⁾

Monitoring:

Regular clinical and laboratory monitoring (especially leucocyte count) are advised if administration of metronidazole for more than 10 days is considered to be necessary.^(1a-c)

Patients should be monitored for adverse reactions such as peripheral or central neuropathy (such as paresthesia, ataxia, dizziness and convulsive seizures).^(1a)

EXTRAVASATION:

No extreme pH/osmolarity. Refer to local treatment policy.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Aciclovir,⁽⁴⁾ amikacin,^(1a) ampicillin,^{(1a)(4)} cefotaxime,^{(1a)(4)} ceftazidime,⁽⁴⁾ ceftriaxone⁽⁴⁾, cefuroxime,^{(1a)(4)} chloramphenicol,^(1a) ciprofloxacin,⁽⁴⁾ clarithromycin,⁽⁴⁾ clindamycin,^(1a) dopamine,⁽⁴⁾ fluconazole,⁽⁴⁾ gentamicin,^{(1a)(4)} hydrocortisone sodium succinate,^{(1a)(4)}

midazolam,⁽⁴⁾ morphine sulfate,⁽⁴⁾ piperacillin and tazobactam,⁽⁴⁾ remifentanyl,⁽⁴⁾ tacrolimus,⁽⁴⁾ theophylline,⁽⁴⁾ tobramycin.^{(1a)(4)}

Incompatible:

Amphotericin,⁽⁴⁾ co-amoxiclav,⁽⁴⁾ penicillin G potassium,^(1a) compound sodium lactate (Hartmann's),^(1a)

SPECIAL HANDLING PRECAUTIONS:

No special requirements⁽⁸⁾

SODIUM CONTENT (mmol):

Flagyl: 13.4mmol/100mL^(1a)

OSMOLARITY / OSMOLALITY:

The infusion solution has an osmolality of 308-314mOsm/L^{(1c)(4)}

pH:

Metronidazole ready to use has a pH of 5.8 (range 4.5 to 6).^(1c)

OTHER COMMENTS:

1. Store below 25°C, protect from light.^{(1a-c)(4)}
2. Discard any unused portions.^(1a-c)
3. Do not reconnect partially used containers.^(1a-c)
4. Metronidazole in Viaflo bag: Do not remove from overpouch until ready to use.^(1c)
5. Any one of amikacin, cefotaxime, ceftazidime or cefuroxime may be added to an infusion of metronidazole.⁽¹⁰⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Flagyl 500mg in 100mL solution for infusion, Winthrop Pharmaceuticals UK Ltd, last revised 11/05/2011
 - b) Metronidazole 500mg in 100mL solution for infusion, B.Braun Melsung AG. Last revised February 2004
 - c) Metronidazole 500mg in 100mL intravenous infusion, Baxter Healthcare Ltd, last revised April 2011
2. Martindale accessed via <http://www.medicinescomplete.com> on 06/03/2012
3. American Hospital Formulary Service Drug Information 2011, accessed via <http://www.medicinescomplete.com> on 06/03/2012
4. Trissel "Handbook on injectable drugs" 16th Edition accessed via <http://www.medicinescomplete.com> on 06/03/2012
5. British National Formulary No. 63 March 2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012; page 296
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)

8. COSHH report compiled by manufacturer
9. Drug company name: Winthrop Pharmaceuticals
Date contacted: 9 March 2010
10. UCLH Injectable Medicine Guide, 2010

Version 3 (NHS Lothian local amendment)

Intravenous

Midazolam

Caution - Risk of overdose when administering for conscious sedation⁽¹⁰⁾

MEDICINE NAME:

TRADE NAME(S):

Midazolam

Hypnovel® (Roche).
Midazolam (Mercury Pharma (was Goldshield), Martindale Pharma, hameln,
Accord, Wockhardt, Auden McKenzie)

PRESENTATION OF MEDICINE:

Ampoules containing midazolam hydrochloride 1mg in 1mL; 1mg in 1mL,^(1c) 2mg in 2mL,^{(1b)(1d)}
50mg in 50mL,^{(1d)(1e)} 10mg in 10mL,^(1b) 50mg in 50mL.^(1f)

Ampoules containing midazolam hydrochloride 2mg in 1mL; 2mg in 1mL,^{(1b)(1d)} 10mg in 5mL,^{(1a-c)(1g)}
50mg in 25mL,^(1b-c) 100mg in 50mL.^{(1b)(1f)}

Ampoules containing midazolam hydrochloride 5mg in 1mL; 5mg in 1mL,^{(1b)(1e)} 10mg in 2mL,^{(1a-c)(1g)}
15mg in 3mL,^{(1b)(1e)} 25mg in 5mL,^(1b) 50mg in 10mL,^{(1b-c)(1e)} 90mg in 18mL.^(1b)

METHOD OF ADMINISTRATION:

Conscious sedation:

A NPSA Rapid Response Report has been issued in relation to inadvertent overdose when midazolam is used for this indication.⁽¹⁰⁾ See 'Other Comments' section for more information.

Adults:

The initial dose is administered 5 to 10 minutes before the procedure, by slow intravenous injection over at least 30 seconds. Onset of action is approximately 2 minutes, maximum effect is seen in about 5 to 10 minutes. Further small doses can be administered as necessary. Ensure correct presentation of midazolam is used to reduce the risk of overdose.^(1a)

Children:

The initial dose of midazolam should be administered over 2 to 3 minutes. Wait an additional 2 to 5 minutes to fully evaluate the effect.

Induction of anaesthesia:

Adults:

The anticipated total dose for induction should be given slowly in increments. Each increment should be given slowly over at least 20 to 30 seconds, allowing 2 minutes between successive increments.^(1a)

Sedative component in combined anaesthesia:

Adults:

Administered as either further intermittent small doses or as a continuous intravenous infusion.^(1a)

Sedation in Critical Care

Adults:

The desired level of sedation is reached by stepwise titration of midazolam followed by either continuous infusion or intermittent bolus. The intravenous loading dose should be given slowly over 20 to 30 seconds allowing 2 minutes between successive increments.^(1a)

Children:

Initial loading dose may not be required.^(6a) A loading dose should be administered over at least 2 to 3 minutes. The loading dose is followed by a continuous IV infusion.^(1a)

For administration of midazolam injection, the patient should be placed in a supine position and remain there throughout the procedure.

Resuscitation facilities should always be available and a second person, fully trained in the use of such equipment, always present. Flumazenil should always be available.

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹⁴⁾ If a central venous access device is unavailable a risk benefit analysis should be made on an individual patient basis. If given peripherally, the insertion site must be monitored closely for phlebitis using a recognised infusion phlebitis scoring tool.⁽¹⁴⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: Dilute with glucose 5% or sodium chloride 0.9%

Adults: Standard concentration for infusion 1mg in 1mL (2mg in 1mL is sometimes used).⁽¹¹⁾⁽¹³⁾

Children under 15kg: Concentration of infusion should not exceed 1mg in 1mL.⁽⁵⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours when prepared in the clinical area^(1a)

EXAMPLE CALCULATION:

Infusion rate: The infusion rate can be calculated from the following equation:

$$\text{Midazolam infusion rate (mL/hour)} = \frac{\text{Dose (micrograms/kg/hour)} \times \text{patient weight (kg)}}{1,000 \times \text{Concentration (mg/mL)}}$$

For example: To administer a dose of 40micrograms/kg/hour of midazolam to a 70kg patient using a standard solution of 50mg in 50mL (1mg in 1mL), the calculation would look as follows:

$$\text{Midazolam infusion rate (mL/hour)} = \frac{40 \text{ (micrograms/kg/hour)} \times 70 \text{ (kg)}}{1,000 \times 1 \text{ (mg/mL)}} = 2.8 \text{ mL/hour}$$

FLUSHING:

Flush with glucose 5%⁽⁴⁾ or sodium chloride 0.9%⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Midazolam injection may cause respiratory depression and respiratory arrest particularly when used for conscious sedation. Risk factors are high doses, rapid injection, use in elderly patients or patients receiving a combination of drugs. Midazolam must only be administered where resuscitation facilities and flumazenil are available.⁽⁵⁾⁽¹⁰⁾

Abrupt discontinuation after prolonged intravenous administration of midazolam may lead to withdrawal symptoms.

Midazolam causes a dose dependent anterograde amnesia. Prolonged amnesia can present problems in outpatients.

Paradoxical reactions such as agitation, involuntary movements (including tonic/clonic convulsions and muscle tremor), hyperactivity, hostility, rage reaction, aggressiveness, paradoxymal

excitement and assault can occur with midazolam. Highest incidence is with high doses, rapid administration, in children and the elderly.^{(1a)(5)}

Tenderness at the site of injection and pain during injection occur in 5-6% of patients.⁽³⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to low pH. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusions (it is assumed that medicines meet close to the vascular access device): Adrenaline, amikacin, amiodarone (in glucose 5%), atracurium, calcium gluconate, caspofungin (in sodium chloride 0.9%), cefotaxime, cisatracurium, clindamycin, digoxin, dopamine, erythromycin, esmolol, fentanyl, fluconazole, gentamicin, glyceryl trinitrate, haloperidol, heparin sodium, insulin soluble, labetalol, methylprednisolone, metronidazole, milrinone, morphine sulfate, noradrenaline (in glucose 5%), potassium chloride, propofol, ranitidine, remifentanyl, sodium nitroprusside (in glucose 5%), tobramycin, vancomycin, vecuronium.⁽⁴⁾
Clonidine, ketamine, morphine.⁽¹⁵⁾

Compatible infusion fluids: Glucose 5%, sodium chloride 0.9%, glucose 4% with sodium chloride 0.18%.

Incompatible infusion fluids: Compound sodium lactate (Hartman's).^{(1a)(1d)}

Incompatible infusions: Albumin, amoxicillin, amphotericin, ampicillin, ceftazidime, cefuroxime, co-amoxiclav, co-trimoxazole, dexamethasone, fosphenytoin, furosemide, hydrocortisone, imipenem, omeprazole, pantoprazole, sodium bicarbonate, thiopental.⁽⁴⁾
Aciclovir, alteplase, diazepam, flecainide, phenobarbital, phenytoin.^(1b)

The following are usually incompatible, infuse separately if possible. Parental nutrition solutions, sodium bicarbonate infusions, phosphate preparations, blood components, plasma substitutes.

SODIUM CONTENT (mmol):

Negligible

OSMOLARITY / OSMOLALITY:

185 to 310mOsmol/kg^{(9b)(9d)}

pH:

2.9 to 3.7^(9a-e)

OTHER COMMENTS:

1. Risk of overdose of midazolam in adults when it is given for conscious sedation prior to procedures such as dentistry, endoscopy and minor operations. Give small incremental doses as detailed under 'Method and Administration.' Use only ampoules containing 1mg/mL for this indication. Ensure flumazenil is always available.⁽¹⁰⁾
2. Preparations containing midazolam 2mg/mL and 5mg/mL should only be stocked and used for general anaesthesia, intensive care, palliative medicine and in other areas in which it has been formally risk assessed.⁽¹⁰⁾
3. Midazolam is a Schedule 3 Controlled Drug (CD). Midazolam is exempt from storage requirements, i.e. does not need to be stored in a CD cupboard.⁽¹²⁾ Do not store above

25°C. ^(1b-d)

4. Keep in the outer carton, protect from light during storage. ^(1a-e)
5. There is no evidence of adsorption of midazolam on to the plastic of infusion apparatus or syringes.

REFERENCES:

1. Summary of Product Characteristics
 - a) Hypnovel, Roche, last revised April 2012
 - b) Midazolam injections, Hameln Pharmaceuticals Ltd, last revised 09/12/2010
 - c) Midazolam injection, Mercury Pharma Group (Goldshield), last revised February 2012
 - d) Midazolam injection, Wockhardt, last revised October 2008
 - e) Midazolam Injections, Accord Healthcare, last revised 21/7/2011
 - f) Midazolam injection, Martindale Pharma, last updated January 2009
 - g) Midazolam injection, Auden McKenzie, last revised 06/06/2011
2. Martindale accessed via www.medicinescomplete.com/mc on 11/07/2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com/mc on 11/07/2012
4. Trissel 'Handbook on injectable drugs' 16th Edition
5. British National Formulary No. 63, March 2012, pg 824-825, 999
6. Medicines for Children produced by the Royal College of Paediatric Health 2003, pg 412-415
 - a) British National Formulary for Children 2011-2012, pg 638-639
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. European Pharmacopoeia Commission Safety Data Sheet. Date of revision 04/01/2006
9.
 - a) Drug company name: Roche. Date contacted: 24/05/2012
 - b) Drug company name: hameln. Date contacted: 18/05/2012
 - c) Drug company name: Mercury Pharma Group (Goldshield). Date contacted: 16/05/2012
 - d) Drug company name: Wockhardt. Date contacted: 19/05/2012
 - d) Drug company name: Accord Healthcare. Date contacted: 19/05/2012
10. Reducing risk of overdose with midazolam injection in adults. Rapid Response Report. NPSA/2008/RRR011. [Reducing risk of overdose with midazolam injection in adults](#)
11. A survey to inform standardisation of intravenous medication concentrations in critical care. M Borthwick et al. Journal of the Intensive Care Society 2007;8:92
12. Medicine, Ethics and Practice. Edition 36 July 2012. Royal Pharmaceutical Society of Great Britain.
13. Standard concentrations for infusions used in critical care areas. The Intensive Care Society website (2010) [See Link](#)
14. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
15. Chemical and Physical Compatibility of Continuous Intravenous Drug Infusion Combinations used in Paediatric Intensive Care. Andy Fox, Marisa van der Merwe et al. Presented at NPPG annual conference Nov 2012

Version 5 (NHS Lothian local amendment)

Intravenous

Milrinone

MEDICINE NAME:

Milrinone

TRADE NAME(S):

Primacor®

PRESENTATION OF MEDICINE:

Ampoules containing 10mg in 10mL (as lactate).⁽⁵⁾

50mL pre-filled syringes containing milrinone in various different concentrations are available as an NHS 'special' (see ProFile in 'CURRENT SUPPLIERS' section).

METHOD OF ADMINISTRATION (adult):

ADULT: Administer an initial loading dose by **IV injection** over 10 minutes followed by a **continuous infusion**.⁽¹⁾

CHILD (1 month to 18 years) and NEONATE: Administer an initial loading dose by **IV injection** over 30-60 minutes followed by a **continuous infusion**.^{(1)(6a)}

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹⁰⁾

Administer using an infusion pump.

The loading dose can be given diluted (see below) or undiluted if the patient is fluid restricted.^{(5)(6a)} Milrinone can be given undiluted as long as the giving set used is of high enough accuracy to ensure that the dose given in terms of micrograms/kg/minute does not exceed that quoted in the SPC.

Patients should be monitored closely.⁽⁹⁾

Renal impairment: dosage adjustment required.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

IV injection (loading dose): Dilute the volume of injection required for the loading dose to a total volume of 10mL or 20mL.⁽³⁾ with sodium chloride 0.9% or glucose 5%.⁽¹⁾

IV infusion (maintenance infusion): Prepare a 50mL solution containing milrinone 200micrograms/mL by mixing 10mL of milrinone 10mg in 10mL injection with 40mL of sodium chloride 0.9% or glucose 5%.⁽¹⁾

Solutions of different concentrations may be used according to patient fluid requirements.⁽¹⁾

Concentrations of 400micrograms/mL have been used.^(6a)

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

24 hours.⁽¹⁾

EXAMPLE CALCULATION (adult):

The infusion rate can be calculated from the following equation:

$$\text{Milrinone infusion rate (mL/hour)} = \frac{\text{Dose (micrograms/kg/minute)} \times \text{patient weight (kg)} \times 60}{\text{Concentration (micrograms/mL)}}$$

For example: To administer a dose of 0.4micrograms/kg/minute of milrinone to a 70kg patient

using a standard solution of 10mg in 50mL (200micrograms in 1mL), the calculation would look as follows:

$$\text{Milrinone infusion rate(mL/hour)} = \frac{0.4(\text{micrograms/kg/minute}) \times 70(\text{kg}) \times 60}{200(\text{micrograms/mL})} = 8.4\text{mL/hour}$$

FLUSHING:

Sodium chloride 0.9% or glucose 5%.⁽¹⁾⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Cases of infusion site reaction have been reported with milrinone injection. Consequently, careful monitoring of the infusion site should be maintained so as to avoid possible extravasation.⁽¹⁾

Hypotension:⁽¹⁾ monitor blood pressure.

Arrhythmias:⁽¹⁾ continuous ECG monitoring required - stop infusion if arrhythmias develop.⁽¹⁾

Tachycardia:⁽¹⁾ monitor heart rate.

Hypokalaemia:⁽¹⁾ monitor electrolytes and fluid balance. Monitor renal function.

Very rare: anaphylactic shock⁽¹⁾ - stop infusion and treat according to local policy.

EXTRAVASATION:

Extravasation may cause tissue damage as the pH is less than 5. If extravasation occurs refer to local treatment policies.⁽¹¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusions (it is assumed that medicines meet close to the vascular access device):⁽⁴⁾ Adrenaline, amiodarone, dobutamine, dopamine, heparin, insulin soluble, lorazepam, midazolam, morphine sulfate, noradrenaline, potassium chloride, propofol, vancomycin

Compatible infusion fluids: Sodium chloride 0.9%,⁽¹⁾ glucose 5%,⁽¹⁾ sodium chloride 0.45%,⁽¹⁾⁽³⁾ sodium chloride with glucose,^(6a) Ringer's lactate⁽⁴⁾

Incompatible: Furosemide, bumetanide, sodium bicarbonate.⁽¹⁾

SODIUM CONTENT (mmol):

Nil⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Milrinone solution is isotonic⁽⁹⁾

pH:

3.2 to 4.0⁽⁴⁾

OTHER COMMENTS:

1. Do not store above 25°C, do not freeze.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Primacor injection. Last revised 19/07/2011
2. Martindale accessed via www.medicinescomplete.com/mc on 01/03/2013
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com/mc/ on 01/03/2013
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com/mc/ on 01/03/2013
5. British National Formulary No. 64, February 2013, accessed via www.bnf.org/bnf on 01/03/2013
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2012-2013, accessed via <http://bnfc.org> on 01/03/2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Sanofi-Aventis
Date contacted: 01/03/2013 (information provided on 18/05/2010 still valid)
10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
11. The National Extravasation Information Service available at www.extravasation.org

Version 4

Intravenous

Iron isomaltoside 1000 (Monofer)

The MHRA issued updated advice (see 'Method of Administration' below) on administration and monitoring of intravenous iron preparations dated August 2013 which is included in this monograph but may not be reflected in the package insert.

MEDICINE NAME:

Iron isomaltoside 1000

TRADE NAME(S):

Monofer®

PRESENTATION OF MEDICINE:

Vials containing 100mg/mL iron isomaltoside in 1mL, 5mL and 10mL

Each 1mL contains 100mg iron as iron(III) isomaltose 1000.

METHOD OF ADMINISTRATION (adult):

IV injection

100mg to 200mg may be given up to three times a week as an intravenous injection at a rate of up to 50mg iron/minute.⁽¹⁾

IV infusion

Doses of 200mg to 1000mg can be administered once every week as an intravenous infusion until the total iron dose has been administered. The rate of infusion is dependent upon the dose as follows:⁽¹⁾

- Doses of 0-5mg iron/kg body weight must be infused over 15 minutes.
- Doses of 6-10mg iron/kg body weight must be infused over 30 minutes.
- Doses of 11-20mg iron/kg body weight must be infused over 60 minutes.

'Total dose' IV infusion

A total dose infusion (i.e. total iron dose is given in a single infusion) can be administered as a single dose of up to 20mg iron/kg body weight as an intravenous drip infusion. The rate of infusion is dependent upon the dose as follows:⁽¹⁾

- Doses of 0-10mg iron/kg body weight must be infused over 30 minutes.
- Doses of 11-20mg iron/kg body weight must be infused over 60 minutes.

If the total iron dose exceeds 20mg iron/kg body weight, the dose must be split in two administrations with an interval of at least one week.

New advice from the MHRA: Recommendations to manage and minimise risk of serious hypersensitivity reactions. Issued August 2013. See link below

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

For IV injection

No further dilution of the 100mg/mL solution is required but the required dose may be diluted in 10 to 20mL of sodium chloride 0.9% if desired.⁽¹⁾

For IV infusion

Add total required dose to 100mL to 500mL sodium chloride 0.9%.⁽¹⁾

For 'Total dose' IV infusion

Add total required dose to 100-500mL sodium chloride 0.9%.⁽¹⁾

EXAMPLE CALCULATION (adult):

Local protocols with dosing tables may be available. Please refer as appropriate.

FLUSHING:

Sodium chloride 0.9%⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Parenteral administration of all iron complexes may cause immediate severe and potentially lethal hypersensitivity reactions. Anaphylactoid reactions to parenteral iron are usually evident within a few minutes, and close observation is necessary to ensure recognition. There is particularly increased risk of allergic reactions to parenteral iron complexes in patients with immune or inflammatory conditions (e.g. systemic lupus erythematosus, rheumatoid arthritis). If at any time during the intravenous administration of Monofer®, any signs of a hypersensitivity reaction or intolerance are detected, administration must be stopped immediately.⁽¹⁾

Resuscitative medication and personnel trained to evaluate and handle anaphylactoid reactions should be available whenever a dose of parenteral iron is administered.⁽¹⁾

Total dose infusion (TDI) has been associated with an increased incidence of adverse reactions, in particular delayed hypersensitivity-like reactions. The intravenous administration of Monofer® by the total dose infusion method should be restricted to hospital use only.⁽¹⁾

Parenteral iron should be used with caution in case of acute or chronic infection. Monofer® should not be used in patients with ongoing bacteraemia.⁽¹⁾

Hypotensive episodes may occur if intravenous injection is administered too rapidly.⁽¹⁾

EXTRAVASATION:

No information⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device): Sodium chloride 0.9%⁽¹⁾⁽⁵⁾

Incompatible: Do not infuse with any other medicines or infusion fluids.

SODIUM CONTENT (mmol):

0.0003mmol/100mg iron (undiluted) which is negligible.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

1000mOsmol/kg.⁽⁹⁾

pH:

Between 5.0 and 7.0.⁽⁹⁾

OTHER COMMENTS:

Store vials below 30°C.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Monofer®, last updated 18 January 2010
2. Martindale "The Complete Drug Reference" 2011, 37th Edition
3. American Hospital Formulary Service Drug Information" - not used
4. Trissel "Handbook on injectable drugs" 16th Edition
5. British National Formulary No. 63, March 2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin "Infusion systems MDA DB2003(02) March 2003"
8. COSHH report compiled by manufacturer
9. Drug company name: Pharmacosmos UK Ltd. Date contacted: 13/07/2012 (personal communication)
10. www.extravasation.org.uk accessed on 07/07/2012

Version 1.1

Intravenous

Morphine sulphate

MEDICINE NAME:

Morphine sulphate

TRADE NAME(S):

Non-proprietary available from:
hameln
Wockhardt
Cardinal Health Martindale
Torbay Manufacturing Unit
UCB Pharma Ltd

PRESENTATION OF MEDICINE:

Ready to use preparations (for injection):

Ampoules containing morphine 10mg in 1mL. ^{(1a)(1b)(1e)(1h)}

Ampoules containing morphine 15mg in 1mL. ^{(1c)(1f)(1i)}

Ready to use preparations (for infusion):

Vials containing morphine 50mg in 50mL for intravenous infusion. ^(1k)

Vials containing morphine 100mg in 50mL for intravenous infusion. ^(1l)

Preparations requiring further dilution:

Ampoules containing morphine 30mg in 1mL, ^{(1d)(1g)(1j)} 60mg in 2mL. ^{(1d)(1j)}

These products are intended for preparation of intravenous infusions only and MUST be diluted before use.

METHOD OF ADMINISTRATION:

IV injection:

Slow intravenous injection at a maximum rate of 2mg/minute. ⁽⁵⁾

Use low strength morphine ampoules only, e.g. morphine 10mg/mL, to reduce the risk of overdose. ⁽¹⁰⁾

N.B The patient may not require the contents of the whole ampoule selected for use. Check the dose is appropriate for the patient before administration

IV infusion:

Adults: Start at 1-2mg/hour. ^(1a)

Use ready to use infusion preparations where available.

Patient Controlled Analgesia (PCA):

Adults: Start at initial demand dose of 1mg with a lockout period of 5 to 10 minutes. ^(1k-l)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV Injection: Ampoules may have a low pH. It is preferable to dilute with 3 to 5mL sodium chloride 0.9% or glucose 5% before injecting, this will also aid slow administration.

IV Infusion: Use 50mg in 50mL or 100mg in 50mL.⁽¹¹⁾ If ready to use preparations are unavailable use 30mg/mL preparation to prepare the infusion.⁽¹⁰⁾ Dilute the required amount with sodium chloride 0.9% or glucose 5%.

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Rapid injection may increase the frequency of opiate-induced side-effects. These include severe respiratory depression, apnoea, hypotension, peripheral circulatory collapse, chest wall rigidity, cardiac arrest and anaphylactic shock.⁽³⁾

Pain and irritation at the injection site may occur, as well as generalised histamine-mediated reactions such as urticaria and pruritis.^{(1k)(1l)(1i)}

Monitor blood pressure, heart and respiratory rate.

Naloxone must be available in all clinical areas where intravenous morphine is stored or administered. Naloxone is a short-acting antagonist of morphine and repeated doses or an infusion may be necessary to fully reverse the effects of morphine.⁽¹⁰⁾

EXTRAVASATION:

Ampoules may have a low pH. If extravasation occurs refer to local treatment protocols.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Adrenaline, aminophylline, amiodarone, atracurium, calcium chloride, cisatracurium, digoxin, dobutamine, dopamine, erythromycin, esmolol, fentanyl, fluconazole, gentamicin, glyceryl trinitrate, hydrocortisone, insulin, labetalol, magnesium sulphate, methylprednisolone, metronidazole, midazolam, milrinone, noradrenaline, pancuronium, potassium, propofol, remefentanyl, vancomycin, vecuronium.⁽⁴⁾

Acetylcysteine, alfentanil, clonidine, dopexamine, salbutamol.⁽¹²⁾

Incompatible: Likely to be incompatible with alkaline agents.^(1b-d)

Aciclovir, furosemide, phenytoin, thiopental sodium.⁽⁴⁾

Co-trimoxazole, heparin, omeprazole, sodium bicarbonate.⁽¹²⁾

SODIUM CONTENT (mmol):

Ampoules: negligible.^(9a-c)

Syringes: 7.7mmol per 50mL.^(9e)

OSMOLARITY / OSMOLALITY:

270 to 310mOsmol/kg.^(9a)

pH:

2.5 to 6.5.^(9a-e)

See table in link.

OTHER COMMENTS:

1. The NPSA have highlighted the potential risk of administration of high doses of morphine (30mg or more) to patients who have not previously received opiates.⁽¹⁰⁾ This has most often occurred as a result of morphine 30mg ampoules being selected in error, instead of lower strength ampoules, resulting in overdose. Higher strength ampoules, for example morphine 30mg/mL, must be stored separately from lower strength ampoules and used only to prepare infusion or PCA syringes.
2. The hameln pharmaceuticals product does not contain sodium metabisulphite.^(1a)

REFERENCES:

1. Summary of Product Characteristics
 - a) Morphine sulphate injection 10mg/mL, hameln pharmaceuticals, last updated 23/12/2010
 - b) Morphine sulphate 10mg/mL injection, Wockhardt UK Ltd, last updated 17/03/2010
 - c) Morphine sulphate 15mg/mL injection, Wockhardt UK Ltd, last updated 17/03/2010
 - d) Morphine sulphate 30mg/mL injection, Wockhardt UK Ltd, last updated 17/03/2010
 - e) Morphine sulphate 10mg/mL injection, Macarthy's Laboratories Ltd T/A Martindale Pharmaceuticals, last updated 19/02/2008
 - f) Morphine sulphate 15mg/mL injection, Macarthy's Laboratories Ltd T/A Martindale Pharmaceuticals, last updated 02/2003
 - g) Morphine sulphate injection 30mg/mL, Macarthy's Laboratories Ltd T/A Martindale Pharmaceuticals, last updated 02/2003
 - h) Morphine sulphate injection 10mg/mL, Auden McKenzie Ltd, last updated 17/02/2011
 - i) Morphine sulphate injection 15mg/mL, Auden McKnezie Ltd, last updated 17/02/2011
 - j) Morphine sulphate injection 30mg/mL, Auden McKenzie Ltd, last updated 17/02/2011
 - k) Morphine sulphate 1mg/mL injection, Torbay Manufacturing Unit, last updated 11/2003
 - l) Morphine sulphate 2mg/mL injection, Torbay Manufacturing Unit, last updated 23/05/2006
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 01/03/2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 01/03/2011
4. Trissel "Handbook on Injectable Drugs" 15th Edition pg 1119-1140
5. British National Formulary No. 61 pg 268

6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003, pg 422-6
 - a) British National Formulary for Children 2010-11, pg 262
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer
 - a) Hameln, last updated May 2006
 - b) Auden McKenzie, last updated Jan 2011
9.
 - a) Drug company name: Hameln. Date contacted: 29/04/2011
 - b) Drug company name: Wockhardt. Date contacted: 26/04/2011
 - c) Drug company name: Cardinal Health Martindale. Date contacted: 09/02/2011
 - d) Drug company name: Auden McKenzie. Date contacted: 08/03/2011
 - e) Drug company name: Torbay Manufacturing Unit. Date contacted: 02/03/2011
10. Ensuring safer practice with high dose ampoules of diamorphine and morphine. NPSA Safer Practice Note 12, 25/05/2006
11. Intensive Care Society website statement supporting use of standard infusion concentrations (2010) [See Link](#)
12. Handbook of Drugs in Intensive Care, 4th Edition, Paw H and Shulman R.

Version 4 (NHS Lothian local amendment)

Intravenous

Mycophenolate mofetil

MEDICINE NAME:

Mycophenolate mofetil

TRADE NAME(S):

Cellcept®

PRESENTATION OF MEDICINE:

Vial containing powder for concentrate for solution for infusion equivalent to 500mg mycophenolate mofetil (as hydrochloride salt)⁽¹⁾

METHOD OF ADMINISTRATION:

Mycophenolate mofetil should **never** be administered by rapid or bolus intravenous injection.⁽¹⁾

IV infusion: Slow IV infusion over 2 hours.⁽¹⁾ Use an infusion pump. Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹⁰⁾ If a central venous access device is unavailable a risk benefit analysis should be made on an individual patient basis. If given peripherally, the insertion site must be monitored closely for phlebitis using a recognised infusion phlebitis scoring tool.⁽¹⁰⁾

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute each 500mg vial with 14mL of glucose 5% ⁽¹⁾⁽⁵⁾ Gently shake to dissolve, gives a slightly yellow solution.⁽¹⁾ If discolouration or particulate matter observed, discard.⁽¹⁾

Requires further dilution before administration⁽¹⁾ - see below

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Add the contents of two reconstituted vials (1g dose) (approximately 2 x 15mL) into 140mL of glucose 5%.⁽¹⁾

Final concentration is 6mg in each 1mL.⁽¹⁾

Discard infusion solution if discolouration or particulate matter observed.

Glucose 5% is recommended for reconstitution and dilution of mycophenolate mofetil hydrochloride.⁽¹⁾

All other solutions are stated to be incompatible.⁽⁴⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

The commencement of administration of the infusion solution should be within 3 hours from reconstitution and dilution.⁽¹⁾

FLUSHING:

Glucose 5%⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypersensitivity - including angioneurotic oedema and anaphylactic reaction.⁽¹⁾
Phlebitis and thrombosis.⁽¹⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage because of the low pH. If extravasation occurs refer to local policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

1. Because mycophenolate mofetil has demonstrated teratogenic effects in rats and rabbits, avoid direct contact of the prepared solution with skin or mucous membranes.⁽¹⁾
2. If drug comes into contact with skin or mucous membranes, wash thoroughly with soap and water; rinse eyes with plain water.⁽¹⁾

SODIUM CONTENT (mmol):

Negligible.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

The osmolality of the final infusion solution is determined mainly by the diluent (glucose 5%). The contents of 2 vials of Cellcept® provides a maximum of 5mmols of solute molecules/ions to the final infusion solution (concentration 6mg in 1mL).⁽⁹⁾

pH:

Range of 2.7 to 4.1 for both the reconstituted concentrate and the final infusion solution.⁽⁹⁾

OTHER COMMENTS:

1. CellCept® 500mg powder for concentrate for solution for infusion does not contain an antibacterial preservative; therefore, reconstitution and dilution should be performed under aseptic conditions.⁽¹⁾ Reconstitution and dilution should preferably be performed in Pharmacy.
2. Contraindicated in patients allergic to Polysorbate (Tween®) 80.⁽¹⁾
3. The reconstituted vials and final infusion solution are chemically and physically stable with glucose 5% in glass containers, and in polyvinylchloride (PVC) bags and administration sets.
4. Powder for concentrate for solution for infusion: Do not store above 30°C. Reconstituted vials and final infusion solution: Store at 15-30°C.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Cellcept 500mg powder. Last revised 20/07/2012

2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com on 16/01/2013
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 10/12/2012
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com on 16/01/2013
5. British National Formulary No. 64, September 2012 accessed via <http://www.bnf.org/bnf>
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 pg 432
a) British National Formulary for Children 2010-11 via <http://www.bnfc.org/bnfc>
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer - Safety data sheet 31.12.10/CSE (SEISMO)
9. Drug company name: Roche Products Ltd. Date contacted: 18/05/2011; 12/02/2013
10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 5

Intravenous

Naloxone hydrochloride

Note: In NHS Lothian the information in this monograph is NOT to be used for the following:

- **Palliative Care patients. Please see the NHS Lothian Palliative Care Guidelines for Naloxone in Palliative Care on the Intranet.**
- **Post general anaesthesia. Please see Theatres & Anaesthetics protocol.**

MEDICINE NAME:

Naloxone
hydrochloride

TRADE NAME(S):

Naloxone hydrochloride (Hameln, Goldshield, UCB Pharma (was IMS Ltd), Wockhardt., B. Braun)

PRESENTATION OF MEDICINE:

400micrograms in 1mL ampoule^{(1a)(1b)(1e)}

400micrograms in 1mL, 2mL and 5mL pre-filled syringe (Minijet)^(1d)

40micrograms in 2mL ampoule^(1c)

METHOD OF ADMINISTRATION:

REVERSAL OF CNS AND RESPIRATORY DEPRESSION CAUSED BY NATURAL OR SYNTHETIC OPIOIDS IN SUSPECTED OPIOID OVERDOSE OR INTOXICATION

Adults and children aged 12 years and over - IV injection: Administer by slow IV injection as follows ⁽¹³⁾

- Give an initial dose of 400 micrograms (0.4 mg) by slow IV injection. ⁽¹⁾⁽⁵⁾
- If there is no response after 60 seconds, give a further 800 micrograms (0.8 mg).
- If there is still no response after another 60 seconds, give another 800 micrograms (0.8 mg).
- If still no response (after a total of 2 mg), give a further 2 mg dose. Large doses (4 mg) may be required in a seriously poisoned patient.

Aim for reversal of respiratory depression, not full reversal of consciousness.

Once an adequate response has occurred, monitor blood gases, oxygen saturation, and respiratory rate. Observe the patient carefully for recurrence of CNS and respiratory depression. The duration of action of naloxone is shorter than that of all opioid analgesics - **REPEATED DOSES OF NALOXONE MAY BE REQUIRED.** ⁽¹³⁾

Adults and children aged 12 years and over - IV Infusion: Intravenous infusions of naloxone are often useful where repeated doses are required. The rate of administration should be titrated in accordance to patient's response to IV bolus and reaction to IV infusion. Usual starting dose is 60% of initial IV bolus dose required for resuscitation infused over 1 hour, then adjusted according to respiratory rate and level of consciousness. ⁽¹⁾⁽⁵⁾⁽¹³⁾

Note: Intramuscular naloxone is an alternative in the event that intravenous access is not possible, or

if the patient is threatening to self-discharge when it may help reduce the risk of respiratory arrest.⁽¹³⁾
The onset of action may be slower however.⁽⁵⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV injection: Naloxone may be diluted to a convenient volume with water for injections.⁽¹⁾⁽²⁾⁽⁴⁾

Continuous IV infusion: Dilute 10mg (25 vials of 400micrograms) with 50mL of sodium chloride 0.9%⁽¹⁾⁽⁵⁾ or glucose 5%.⁽⁴⁾⁽¹³⁾ This will give a final solution concentration of 200micrograms/mL. This is an unlicensed concentration but is recommended by National Poisons Information Service. Infuse using an infusion pump.⁽¹³⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

Naloxone hydrochloride solutions diluted in infusion solutions for administration should be discarded after 24 hours.⁽⁶⁾

FLUSHING:

Sodium chloride 0.9%, glucose 5%⁽¹⁾⁽⁴⁾⁽⁵⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Nausea and vomiting.⁽¹⁾

Hypertension, tachycardia, cardiac arrhythmias and pulmonary oedema been reported after postoperative use of naloxone, generally in patients with pre-existing heart disease undergoing cardiac surgery.⁽¹⁾

Tremor, hyperventilation, hypotension, dyspnoea and cardiac arrest have also been reported.⁽¹⁾⁽²⁾⁽⁵⁾

Opioid withdrawal symptoms are common in opioid dependant patients.⁽²⁾⁽⁵⁾

Monitor heart rate and blood pressure.

EXTRAVASATION:

Naloxone is likely to cause extravasation leading to tissue damage due to its low pH of naloxone (see pH below).⁽¹²⁾ Precaution should be taken to avoid extravasation. Ideally drugs likely to cause extravasation should be given through a central line and patients receiving repeated doses of hazardous drugs peripherally should have the cannula resited at regular intervals.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

IV injection:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

IV infusion:

Compatible: with glucose 5% and sodium chloride 0.9%.⁽⁴⁾

Y-site compatibility:

Linezolid 2mg per mL with naloxone 400microgram per mL (compatible for 4 hours at 23°C).⁽⁴⁾
Propofol 10mg per mL with naloxone 400micrograms per mL (compatible for 4 hours at 23°C).⁽⁴⁾

Drugs in Syringe compatibility:

Ondansetron 1.33mg per mL (in sodium chloride 0.9% only) with naloxone 0.133mg per mL (compatible for 24 hours with <6% loss of ondansetron and <5% loss of naloxone).⁽⁴⁾

Heparin sodium 2,500units per mL with naloxone 400micrograms per mL (compatibility for 5 minutes).⁽⁴⁾

Additive compatibility:

Verapamil hydrochloride 80mg per 1000mL with naloxone 800micrograms per 1000mL (in sodium chloride 0.9%) for 24 hours.⁽⁴⁾

Incompatible:

Alkaline solutions or preparations containing bisulphate, or long chain or high molecular weight anions or any solution with an alkaline pH.⁽¹⁾⁽²⁾⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

No information available ⁽¹⁾

SODIUM CONTENT (mmol):

0.15mmol in 1mL for naloxone 400micrograms per mL ampoules ^{(1a)(1e)}

0.15 mmol in 1mL for naloxone 400micrograms per mL (Minijets) ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Naloxone 400micrograms per mL: 270 - 310mOsm/kg⁽⁴⁾

Naloxone 20micrograms per mL: 289 - 293mOsm/kg⁽⁴⁾

Naloxone 400micrograms per mL (Minijets UCB): 301mOsm/kg⁽⁹⁾

pH:

pH ranges from 3 to 6.5 for all preparations⁽⁴⁾

pH of naloxone hydrochloride (Hameln, B.Braun): 3.1 - 4.5^{(1a)(1e)}

pH of naloxone (MiniJets UCB): 3.0 - 4.5⁽⁹⁾

OTHER COMMENTS:

1. Store at room temperature.⁽⁴⁾ Keep container in the outer carton, protect from light on storage only.⁽¹⁾⁽⁴⁾⁽¹⁰⁾
2. Prior to administration, IV solutions of naloxone hydrochloride should be carefully inspected for the presence of particulate matter or discoloration.

REFERENCES:

1. Summary of Product Characteristics
 - a) Hameln Pharmaceuticals, last updated 18/08/2008
 - b) Wockhardt, last updated 12/11/2010

- c) Goldshield Pharmaceuticals, last updated 06/08/2009
- d) UCB Pharma (was IMS Ltd) last updated 07/04/2010
- e) B Braun, last updated last updated Nov 2007
- 2. Martindale accessed via <http://www.medicinescomplete.com> on 20/12/2010
- 3. American Hospital Formulary Service, Drug Information
- 4. Trissel "Handbook on Injectable Drugs" accessed via <http://www.medicinescomplete.com> on 20/12/2010
- 5. British National Formulary No 65 accessed via www.bnf.org.uk/
- 6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003
 - a) British National Formulary for Children 2012-13 accessed via www.bnf.org.uk
- 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
- 8. COSHH report compiled by the manufacturer
- 9. Drug Company name: UCB Pharma
Date contacted: December 2010
- 10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
- 11. UCLH injectable medicines guide, 3rd edition, 2010
- 12. National Extravasation Service. Accessed via <http://www.extravasation.org.uk> on 20/12/10.
- 13. Naloxone in TOXBASE. Available at <http://www.toxbase.org/General-Info/Antidotes---doses-and-sources/Naloxone-antidote/> on 07/06/2013.

Version 1 (NHS Lothian local monograph)

Intravenous

Noradrenaline (norepinephrine)

NB. Always prescribe and prepare the infusion as noradrenaline base

MEDICINE NAME:

Noradrenaline
(norepinephrine)

TRADE NAME(S):

Noradrenaline or Levophed (Hospira)
Generic (Aguettant Ltd, Specials (ProFile)

PRESENTATION OF MEDICINE:

Noradrenaline (base) 2mg in 2mL ampoules^(1a)
Noradrenaline (base) 4mg in 4mL ampoules^(1a-b)
Noradrenaline (base) 20mg in 20mL ampoules^(1a)

Ready diluted products

Noradrenaline (base) 4mg in 50mL, 8mg in 50mL and 16mg in 50mL preparations are available as an NHS 'Special'

Please note: 1mg noradrenaline (base) is contained in 2mg noradrenaline acid tartrate. At present some UK preparations may be described as either noradrenaline base or noradrenaline acid tartrate.⁽⁵⁾

METHOD OF ADMINISTRATION:

IV infusion: Administer using an infusion pump^(1a-b) Noradrenaline is a potent vasoconstrictor and has a low pH, administer via a central venous access device.^{(1a-b)(10)}

Do not allow the infusion to run out. A new infusion should be prepared before the previous one finishes. Reduce the rate of infusion gradually prior to discontinuation to avoid disastrous falls in blood pressure.^{(1b)(2)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Adults: Use ready prepared infusions if available.⁽¹¹⁾

If ready prepared infusions are unavailable, dilute 4mL (4mg noradrenaline base) to 50mL with glucose 5% to give a final concentration of 80micrograms noradrenaline base in 1mL.⁽¹¹⁾

Other preparations in use are 8mg noradrenaline base in 50mL, 16mg noradrenaline base in 50mL or 32mg noradrenaline base in 50mL. In exceptional circumstances, more concentrated solutions may be used.⁽¹²⁾

Children: Dilute to a maximum concentration of 40micrograms/mL noradrenaline base (higher concentrations can be used if fluid-restricted).^(6a)

Check the calculation carefully before starting treatment. ^(1a-b)

Noradrenaline infusion must not be used if it is discoloured (e.g. pink, dark yellow, brown) or contains precipitate.⁽³⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours at room temperature.⁽³⁾

EXAMPLE CALCULATION:

Infusion rate: The infusion rate can be calculated from the following equation:

$$\text{Noradrenaline infusion rate (mL/hour)} = \frac{\text{Dose (micrograms/kg/minute)} \times \text{patient weight (kg)} \times 60 \text{ (minutes)}}{\text{Concentration (micrograms/mL)}}$$

For example: To administer a dose of 0.1 micrograms/kg/minute of noradrenaline to a 70kg patient using a solution of 4mg in 50mL (80micrograms in 1mL), the calculation would look as follows:

$$\text{Noradrenaline infusion rate (mL/hour)} = \frac{0.1 \text{ (micrograms/kg/minute)} \times 70 \text{ (kg)} \times 60 \text{ (minutes)}}{80 \text{ (micrograms/mL)}} = 5.25 \text{ mL/hour}$$

NB: If the rate includes a 0.05 figure, the rate should be rounded UP to the next decimal place when setting the infusion pump, e.g. 5.25mL/hour should be rounded up to 5.3mL/hour.

FLUSHING:

Do not flush the central venous access device. After the infusion is stopped, disconnect the administration set, aspirate the cannula contents and then flush with sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

Headache, weakness, dizziness, pallor, decreased urinary output, respiratory difficulty or apnoea, and precordial pain.⁽³⁾

Vasoconstriction and hypertension, decreased perfusion of kidneys and other organs, tissue hypoxia and metabolic acidosis, especially if hypovolaemic.⁽³⁾

Tremor, hypokalaemia, hyperglycaemia.⁽²⁾

Arrhythmias, bradycardia.⁽³⁾⁽⁵⁾

Peripheral ischaemia causing tissue necrosis and sloughing at injection site, occasionally gangrene of the extremities.⁽²⁾⁽³⁾⁽⁵⁾

Monitoring:

Administration of noradrenaline should preferably be confined to a critical care setting with invasive haemodynamic monitoring.⁽⁵⁾ As a minimum, blood pressure and infusion flow rate should be monitored frequently.⁽²⁾ Resuscitation equipment must be immediately available.

Check the infusion site regularly.^(1a)

EXTRAVASATION:

Noradrenaline is a potent vasopressor and may cause severe tissue hypoxia and ischaemia resulting in necrosis and gangrene. Administer via a central venous access device. If extravasation occurs refer to local treatment policies. This may include infiltration of the affected area with a solution containing phentolamine.^{(1a)(2)(3)}

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

The concomitant administration of noradrenaline and other medicines via a Y-site should be avoided if possible to prevent inadvertent bolus administration of noradrenaline.

Compatible (it is assumed that medicines meet close to the vascular access device):

Adrenaline, amiodarone, cisatracurium, clonidine, dobutamine, dopamine, fentanyl, glyceryl trinitrate, heparin sodium, hydrocortisone, midazolam, milrinone, morphine, potassium chloride, propofol, remifentanyl, vasopressin, vecuronium.⁽⁴⁾

Acetylcysteine, alfentanil, aprotinin, atracurium, calcium chloride, calcium gluconate, digoxin, dopexamine, erythromycin, lidocaine, magnesium sulphate, pancuronium.⁽¹³⁾

Other compatible diluents: Sodium chloride 0.9%,⁽⁴⁾⁽¹³⁾ glucose 5% and sodium chloride 0.9%,⁽⁴⁾ Hartmann's.⁽⁴⁾⁽¹³⁾

Sodium chloride 0.9% not usually recommended as a diluent because of lack of protection from oxidation.⁽⁴⁾

Incompatible:- Alkaline solutions,⁽⁴⁾ insulin, thiopental.⁽⁴⁾

Aminophylline, furosemide, omeprazole, sodium bicarbonate.⁽¹³⁾

SODIUM CONTENT (mmol):

0.14mmol/mL^(9b)

OSMOLARITY / OSMOLALITY:

1mg in 1mL noradrenaline (salt form unspecified) was determined to be 319mOsm/kg⁽⁴⁾

pH:

Undiluted pH is 3 to 4,^(9a) 3 to 4.5^(9b)

OTHER COMMENTS:

1. Do not store ampoules above 25°C (Hospira) or 30°C (Agguetant)

REFERENCES:

1. Summary of Product Characteristics
 - a) Noradrenaline (Norepinephrine) 1:1000 or Levophed, Hospira UK Ltd. Last revised 27/08/2008.
 - b) Noradrenaline (Norepinephrine) 1mg/mL. Laboratoire Aguetant. Last revised 17/06/2010.
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com on 16/06/2011.
3. American Hospital Formulary Service Drug Information, accessed via

- www.medicinescomplete.com on 16/06/2011
4. Trissel "Handbook on injectable drugs" 16th Edition, pg 1163-1169
 5. British National Formulary Edition 62, September 2011, pg 139
 6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003 pg 449-51
a) British National Formulary for Children 2011-2012 pg 113
 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
 8. COSHH report compiled by the manufacturer
a) Hospira, date prepared 25/02/2010
b) Agguetant, date prepared September 2010
 9. a) Drug company name: Hospira. Date contacted: 17/06/2011
b) Drug company: Agguetant. Date contacted: 20/06/2011
 10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
 11. Standard concentrations for infusions used in critical care areas. The Intensive Care Society website (2010) [See Link](#)
 12. UKCPA Critical Care Group. Minimum infusion volumes for fluid restricted critically ill patients. 3rd Ed. 2006, accessed online via www.ukcpa.org.uk 28/06/2011.
 13. Handbook of Drugs in Intensive Care, 4th Edition, Paw H and Shulman R.

Version 4

Intravenous

Immunoglobulin, human normal (Octagam 5%)

Brands of normal human immunoglobulin are not interchangeable.

Record the batch number and expiry date from each bottle used in the patient's case notes or on the drug chart

MEDICINE NAME:

Immunoglobulin, human normal

TRADE NAME(S):

octagam® 5% ⁽¹⁾

PRESENTATION OF MEDICINE:

Glass bottle containing human normal immunoglobulin 100mg in 1mL (5%) solution for infusion:

2.5g in 50mL

5g in 100mL

10g in 200mL ⁽¹⁾

METHOD OF ADMINISTRATION:

IV Infusion: Give at an initial rate of 1mL/kg/hour for 30 minutes. If well tolerated, gradually increase the rate of administration to a maximum 5mL/kg/hour for the remainder of the infusion. Use an infusion pump. ⁽¹⁾

EXAMPLE CALCULATION:

Calculate the infusion rate using the following equation:

Infusion rate (mL/hour) = rate required (mL/kg/hour) x patient weight (kg)

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%. ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Adverse reactions are more likely to occur in patients receiving normal immunoglobulin for the first time, following a prolonged period between treatments, or when a different brand of normal immunoglobulin is administered.
2. Adverse reactions include chills, headache, fever, vomiting, nausea, allergic reactions, arthralgia, low blood pressure and moderate low back pain. These may be related to the infusion rate. If they occur, reduce the rate or stop the infusion.
3. Anaphylactic reactions are rare but can occur even in patients who have tolerated previous treatment with normal immunoglobulin.

Monitoring:

- Monitor the patient (temperature, blood pressure, pulse, respiratory rate) before starting the infusion, throughout the infusion and for 1 hour after the first infusion or 20 minutes after subsequent infusions.
- Monitor urine output and serum creatinine levels. Patients must be well hydrated.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines.⁽¹⁾

SODIUM CONTENT (mmol):

Less than or equal to 15mmol/L ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Greater than or equal to 240mOsmol/kg ⁽¹⁾

The minimum requirement for osmolality of octagam 5% is 240mOsmol/kg with no upper limit set by the quality control; in practice, individual batches have tested in the range between 325-345mOsmol/kg.⁽¹⁰⁾

pH:

5.1 to 6.0 ⁽⁹⁾

OTHER COMMENTS:

1. octagam® should be stored below 25°C and protected from freezing and light.⁽¹⁾
2. The solution should be clear or slightly opalescent. Do not use if it is cloudy or has deposits.⁽¹⁾
3. Filtration of octagam® 5% is not required.⁽¹⁾
4. octagam® 5% contains maltose which may result in falsely elevated blood glucose readings. Ensure the measurement of blood glucose is done with a glucose-specific method for patients receiving octagam® 5%.⁽¹⁾
5. Components used in the packaging of octagam® 5% are latex free.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics. Octapharma Ltd. Last updated 13/01/2009.
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> 11/05/2011.
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> 11/05/2011
4. Trissel 'Handbook on injectable drugs' accessed via <http://www.medicinescomplete.com> 11/05/2011
5. British National Formulary No 61. March 2011. Available via <http://www.bnf.org/bnf/>
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
6a) British National Formulary for Children 2010-11
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Octapharma Limited. Date contacted: 15/05/2012
10. Drug company name: Octapharma Ltd, personal correspondence from 13/07/2012.

Intravenous

Immunoglobulin, human normal (Octagam 10%)

Brands of normal human immunoglobulin are not interchangeable.

Record the batch number and expiry date from each bottle used in the patient's case notes or on the drug chart

MEDICINE NAME:

Immunoglobulin, human normal

TRADE NAME(S):

octagam® 10%

PRESENTATION OF MEDICINE:

Glass bottle containing human normal immunoglobulin 100mg in 1mL (10%) solution for infusion:

2g in 20mL

5g in 50mL

10g in 100mL

20g in 200mL ⁽¹⁾

METHOD OF ADMINISTRATION:

IV Infusion: Give at an initial rate of 0.6mL/kg/hour for 30 minutes. If well tolerated, gradually increase the rate of administration to a maximum 7.2mL/kg/hour for the remainder of the infusion. Use an infusion pump.⁽¹⁾

Bring up to room or body temperature before administration.⁽¹⁾

EXAMPLE CALCULATION:

Calculate the infusion rate using the following equation:

Infusion rate (mL/hour) = rate required (mL/kg/hour) x patient weight (kg)

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Adverse reactions are more likely to occur in patients receiving normal immunoglobulin for the first time, following a prolonged period between treatments, or when a different brand of normal immunoglobulin is administered.
2. Adverse reactions include chills, headache, fever, vomiting, nausea, allergic reactions, arthralgia, low blood pressure and moderate low back pain. These may be related to the infusion rate. If they occur, reduce the rate or stop the infusion.
3. Anaphylactic reactions are rare but can occur even in patients who have tolerated previous treatment with normal immunoglobulin.

Monitoring:

- Monitor the patient (temperature, blood pressure, pulse, respiratory rate) before starting the infusion, throughout the infusion and for 1 hour after the first infusion or 20 minutes after subsequent infusions.
- Monitor urine output and serum creatinine levels. Patients must be well hydrated.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or infusions.⁽¹⁾

SODIUM CONTENT (mmol):

Less than 33mmol/L ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

More than or equal to 240mOsmol/kg.⁽¹⁾

The minimum requirement for osmolality of octagam 10% is 240mOsmol/kg with no upper limit set by the quality control; in practice, individual batches have tested in the range between 325-345mOsmol/kg.⁽¹⁰⁾

pH:

4.5 to 5.0 ⁽¹⁾⁽⁹⁾

OTHER COMMENTS:

1. Store in a refrigerator (2-8°C). Protect from freezing and light. The product may be removed from the refrigerator for a single period of up to 3 months (without exceeding the expiry date) and stored at a temperature below 25°C. At the end of this period, the product should not be refrigerated again and should be disposed of. The date at which the product was taken out of the refrigerator should be recorded on the outer carton.⁽¹⁾
2. The solution should be clear or slightly opalescent. Do not use if the product is cloudy or has deposits.⁽¹⁾
3. Filtration of octagam® 10% is not required.⁽⁹⁾
4. octagam® 10% contains maltose which may result in falsely elevated blood glucose readings. Ensure the measurement of blood glucose is done with a glucose-specific method for patients receiving octagam® 10%.⁽¹⁾
5. Components used in the packaging of octagam® 10% are latex free.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics. Octapharma Ltd. Last updated 25/02/2010.
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 11/05/2011.
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 11/05/2011
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 11/05/2011
5. British National Formulary No 61. March 2011. Available via <http://www.bnf.org/bnf/>
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
6a) British National Formulary for Children 2010-11
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Octapharma Ltd. Date contacted: 15/05/2012
10. Drug company name: Octapharma Ltd, personal correspondence from 13/07/2012.

Intravenous

Octreotide

Subcutaneous injection is the preferred route of administration.⁽¹⁾

Do not confuse with octreotide depot preparation (Sandostatin LAR) which is only given by IM injection.⁽⁴⁾

MEDICINE NAME:

Octreotide

TRADE NAME(S):

Sandostatin®
Octreotide (Sun Pharmaceuticals, Hospira, Novartis)

PRESENTATION OF MEDICINE:

Ampoules/vials containing:

Octreotide 50micrograms in 1mL (as acetate)⁽¹⁾
Octreotide 100micrograms in 1mL (as acetate)⁽¹⁾
Octreotide 500micrograms in 1mL (as acetate).⁽¹⁾

Multidose vials containing:

Octreotide 1mg in 5mL (200micrograms per mL) (as acetate).⁽¹⁾

METHOD OF ADMINISTRATION (adult):

IV injection: Dilute and give by slow IV injection over 3-5 minutes.⁽⁴⁾⁽¹¹⁾

IV infusion (unlicensed): Dilute and give via an infusion pump.

Preferably administer via a central venous access device to avoid potential irritation as the product has a low pH.⁽¹³⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

IV injection and IV infusion: Dilute each mL of octreotide with 1-9mL sodium chloride 0.9%. Do not dilute with glucose 5%.

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

Use infusion within 8 hours of dilution.⁽¹⁾

EXAMPLE CALCULATION (adult):

Infusion rate: Calculate using the following equation:

$$\text{Octreotide infusion rate (mL/hour)} = \frac{\text{Dose (microgram s/kg/hour)} \times \text{patient weight (kg)}}{\text{Concentration (microgram s/mL)}}$$

For example: To administer a dose of 1microgram/kg/hour to a 40kg patient using 100micrograms/mL octreotide ampoule diluted to 5mL with sodium chloride 0.9% to produce a solution of 20micrograms in 1mL, the calculation would look as follows:

$$\text{Octreotide infusion rate (mL/hour)} = \frac{1 (\text{microgram /kg/hour}) \times 40 (\text{kg})}{20 (\text{microgram s/mL})} = 2\text{mL/hour}$$

FLUSHING:

Flush with sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Bradycardia, dyspnoea, arrhythmias. Allergy/hypersensitivity reactions including anaphylaxis and rash.^(1b)

Monitoring: ECG monitoring required for all IV doses.^(1a)

EXTRAVASATION:

Extravasation is likely to cause tissue damage as the pH of this medicine is less than 5.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Octreotide infusion is compatible with the following infusions (it is assumed that medicines meet close to the vascular access device): Heparin (in sodium chloride 0.9% only),⁽⁴⁾ sodium chloride 0.9%

Incompatible: All concentrations of glucose infusion⁽¹⁾ and micafungin. At concentrations of octreotide greater than 5microgram/mL, incompatibility with pantoprazole has been shown.⁽⁴⁾

SODIUM CONTENT (mmol):

Negligible⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Diluted and Undiluted: 284 to 344mOsm/L.⁽⁹⁾⁽¹³⁾

pH:

Diluted and Undiluted: 3.9 to 4.5.⁽⁹⁾⁽¹⁴⁾

OTHER COMMENTS:

1. Store at 2°-8°C. In use, the injection can be stored at room temperature for up to two weeks.^(1b-c) (This does not apply to the Hospira brand). Store in the original container and protect from light.⁽¹⁾
2. The cap of multidose vials should not be punctured more than 10 times to prevent contamination.^{(1a)(1c)}
3. Sandostatin multidose vials do not contain latex but cannot be guaranteed to have been manufactured in a latex-free environment.^(9c)
4. Multidose vials contain phenol.^(1b-c)
5. Sun Pharmaceutical multidose vials are not licensed for IV administration.^(1b)
6. For rapid, direct IV injection (e.g. for carcinoid crisis), injection can be administered undiluted.⁽²⁾⁽¹¹⁾

REFERENCES:

1. Summary of Product Characteristics
a) Octreotide 0.5mg/mL, 0.1mg/mL, last updated Feb 2012; 0.5mg/mL and 0.2mg/mL, last updated December 2012 (Hospira).

- b) Octreotide 0.5mg/mL and 0.05mg/mL (Sun Pharmaceuticals). Last updated October 2012
- c) Sandostatin® 0.05mg/mL, 0.1mg/mL, 0.5mg/mL ampoules and Mutidose vial 1mg/5mL (Novartis). Last updated March 2010
- 2. Martindale accessed via <http://www.medicinescomplete.com> on 12/02/2012
- 3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 12/02/2012
- 4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 12/02/2012
- 5. British National Formulary number 62 accessed via www.bnf.uk on 12/02/2012
- 6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012 accessed via www.bnfc.or.uk on 12/02/2012
- 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
- 8. COSHH report compiled by manufacturer.
 - a) Novartis. Date of issue 25/01/2011
 - b) Sun Pharmaceuticals. Date of issue 05/2011
 - c) Hospira. Date of issue 22/02/2010
- 9.
 - a) Drug company name: Hospira. Date contacted: 02/02/2012 (verbal communication)
 - b) Drug company name: Hospira. Date contacted: 14/02/2012
 - c) Drug company name: Novartis. Date contacted: 27/12/2011 and 12/04/2012 (verbal communication)
- 10. National Extravasation Service accessed via www.extravasation.org.uk accessed on 08/01/2012 - no information
- 11. Paediatric injectable drugs accessed via <http://www.medicinescomplete.com> on 12/02/2012
- 12. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
- 13. Octreotide dilution tables – Osmolarities for Octreotide. QA Department, Charing Cross Hospital
- 14. Octreotide dilution tables – pH for Octreotide. QA Department, Charing Cross Hospital

Version 5

Intravenous

Ondansetron

Do not give more than 16mg as a single IV dose. Higher doses increase the risk of cardiac arrhythmias - see 'Other comments' section below.

MEDICINE NAME:

Ondansetron

TRADE NAME(S):

Zofran®, Ondemet®

Ondansetron (hameln, Wockhardt, Accord, Peckforton)

PRESENTATION OF MEDICINE:

Ampoules containing 4mg ondansetron in 2mL (as hydrochloride dihydrate) solution for injection or infusion.^(1a-f)

Ampoules containing 8mg ondansetron in 4mL (as hydrochloride dihydrate) solution for injection or infusion.^(1a-f)

METHOD OF ADMINISTRATION:

POST-OPERATIVE NAUSEA AND VOMITING⁽¹⁾

IV injection:

Give by slow IV injection over at least 30 seconds and preferably over 2 to 5 minutes.

Adults and children: Maximum dose 4mg.

CHEMOTHERAPY/RADIOTHERAPY INDUCED NAUSEA AND VOMITING:⁽¹⁴⁾

IV injection (adults):

Give by slow IV injection over at least 30 seconds and preferably over 2 to 5 minutes. Maximum single dose 8mg.

Continuous IV infusion (adults): Give at a rate of 1mg/hour for 24 hours.

Short IV infusion: Give over at least 15 minutes before chemotherapy.

Adult: Maximum single dose 16mg.

Child (6 months-18 years): Maximum single dose 8mg.

Note: A new maximum adult dose of 16mg ondansetron by short IV infusion was recommended in August 2012 (from a previous maximum of 32mg). This may not be reflected in package inserts or other prescribing information.

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹²⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV injection: Give undiluted.

Continuous IV infusion: Dilute in 50-500mL sodium chloride 0.9% or glucose 5%.⁽¹⁾

Short IV infusion: Dilute in 50-100mL sodium chloride 0.9% or glucose 5%.⁽¹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours^(1a,c,f)

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypersensitivity reactions, including anaphylaxis, QT prolongation and injection site reactions (e.g. rash, urticaria, itching). Dizziness and transient visual disturbances including blindness during rapid administration.⁽¹⁾ Increasing the infusion time can prevent or resolve dizziness.^(1b)

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to low pH.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Amifostine, amikacin, azithromycin, aztreonam, bleomycin, carboplatin, carmustine, cefotaxime, ceftazidime, cefuroxime, cisatracurium, cisplatin, cladribine, clindamycin, cyclophosphamide, cytarabine, dacarbazine, dactinomycin, daunorubicin, dexamethasone, docetaxel, dopamine, doxorubicin, doxycycline, droperidol, etoposide, filgrastim, fluconazole, fludarabine, gemcitabine, gentamicin, haloperidol, heparin sodium, hydrocortisone sodium succinate, hydromorphone, ifosfamide, imipenem-cilastatin, linezolid, magnesium sulphate, melphalan, mesna, methotrexate, metoclopramide, mitomycin, mitoxantrone, morphine sulphate, oxaliplatin, paclitaxel, pentostatin, pethidine, piperacillin-tazobactam, potassium chloride, prochlorperazine, ranitidine, remifentanyl, sodium acetate, streptozocin, teniposide, thiotepa, ticarcillin-clavulanate, topotecan, tramadol, vancomycin, vinblastine, vincristine, vinorelbine, zidovudine.^{(1c-e)(4)}

Incompatible:

Aciclovir, aminophylline, amphotericin, ampicillin, amsacrine, **fluorouracil (compatible at certain concentrations)**, furosemide, ganciclovir, lorazepam, methylprednisolone sodium succinate, **meropenem (compatible at certain concentrations)**, micafungin, pemetrexed, sargramostim and sodium bicarbonate.⁽⁴⁾⁽¹⁰⁾

Compatible with the following infusion fluids:

Potassium chloride 0.3% with sodium chloride 0.9%,^(1c-f) potassium chloride 0.3% with glucose 5%,^(1c-f) sodium lactate, compound (Hartmann's).⁽¹⁾

SODIUM CONTENT (mmol):

Negligible.⁽¹⁾

OSMOLARITY / OSMOLALITY:

281mOsmol/L⁽¹³⁾

pH:

3.3 to 4.0^(1d)

OTHER COMMENTS:

1. Protect unopened ampoules from light. Do not store above 25°C and do not freeze.^{(1a)(4)}
2. Store diluted solutions at 2-8°C for up to 24 hours and protect from light.^(1a-g)
3. August 2012: The MHRA recommended that the maximum IV dose of ondansetron be restricted to 16mg to reduce the risk of QT interval prolongation and cardiac arrhythmias.

REFERENCES:

1. Summary of Product Characteristics
 - a) Ondansetron, Hameln Pharmaceuticals Ltd. Last revised 15/10/2010
 - b) Zofran®, GlaxoSmithKline UK. Last revised 17/02/2012
 - c) Ondansetron, Wockhardt. Last revised 03/09/2012
 - d) Ondemet®, Alliance Pharmaceuticals. Last revised 29/06/2012
 - e) Ondansetron, Peckforton (Claris Lifesciences), last revised November 2010
 - f) Ondansetron, Accord Healthcare, last revised 16/04/2012
2. Martindale; accessed via www.medicinescomplete.com on 10/07/2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 10/07/2012
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com on 10/07/2012
5. British National Formulary No. 63 March 2012 accessed via www.bnf.org on 10/07/2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 pg 459-460
 - a) British National Formulary for Children 2011-2012 accessed via www.bnfc.org on 10/07/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
 - a) GlaxoSmithKline UK. Last revised 14/07/2008
 - b) Hameln Pharmaceuticals Ltd. Last revised January 2010
 - c) Hospira UK Ltd. Last revised 06/11/2009
9. Am J Health-Syst Pharm 1995;52(22):2570-2573
10. Drug company name: GlaxoSmithKline UK
Date contacted: 07/07/2010
11. BARD. Appendix 1: Drug Information. Accessed via www.accessability-by-bard.co.uk on 06/06/2010
12. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
13. National Extravasation Service, www.extravasation.org.uk
14. [Ondansetron \(Zofran\) Injection 2mg/ml - Revised wording to SPC and Technical Leaflet of Patient Information Leaflet \(PIL\) August 2012](#)

Intravenous

Oxycodone hydrochloride

MEDICINE NAME:

Oxycodone hydrochloride

TRADE NAME(S):

OxyNorm®
Oxycodone (Wockhardt)

PRESENTATION OF MEDICINE:

Ampoules containing oxycodone hydrochloride 10mg in 1mL (equivalent to 9mg of oxycodone base). Solution for injection or infusion.^{(1a)(1b)}

Ampoules containing oxycodone hydrochloride 20mg in 2mL (equivalent to 18mg of oxycodone base). Solution for injection or infusion.^(1b)

Ampoules containing oxycodone hydrochloride 50mg in 1mL (equivalent to 45mg of oxycodone base). Solution for injection or infusion.^(1c)

METHOD OF ADMINISTRATION:

Oxycodone **must be diluted** before intravenous administration (see dilution and diluents section).^(1a-c)

IV injection: Give the diluted solution slowly over 1-2 minutes.⁽¹⁾ Maximum of 10mg dose only.^(1a) Do not administer doses more frequently than every four hours.^(1a-c)

IV infusion: Administer the diluted solution at a recommended starting dose of 2mg/hour.^(1a-c)

IV Patient Controlled Analgesia (PCA): Administer the diluted solution by injection with a minimum lock-out time of 5 minutes (for opioid naive patients).^(1a-c)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

For IV injection, infusion and PCA: Before administering, dilute oxycodone to a concentration of 1mg in 1mL with sodium chloride 0.9% or glucose 5%.^(1a-c)

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

Prepare immediately before use. Chemical and physical in-use stability has been demonstrated for 24 hours at room temperature.^(1a-c)

FLUSHING:

Sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Respiratory depression, hypotension.^(1a-c) Monitor patient appropriately.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Dexamethasone sodium phosphate, haloperidol, hyoscine butylbromide, hyoscine hydrobromide, levomepromazine hydrochloride, metoclopramide hydrochloride, midazolam hydrochloride.^{(1a-c)(4)}

Incompatible: Cyclizine (at concentrations greater than 3mg/mL), prochlorperazine.^{(1a-c)(4)}

SODIUM CONTENT (mmol):

10mg in 1mL ampoule (Wockhardt) - negligible.^{(1b)(9a)}

20mg in 2mL ampoule (Wockhardt) - negligible.^{(1b)(9a)}

Each 10mg in 1mL ampoule (OxyNorm®) contains 0.121mmol sodium.^(9b)

Each 50mg in 1mL ampoule (OxyNorm®) contains 0.043mmol sodium.^(9b)

OSMOLARITY / OSMOLALITY:

The osmolality of OxyNorm® injection is 279 - 288mOsmol/L.^(9b)

pH:

The pH of oxycodone hydrochloride injection is 5.0 - 5.6.^(9a) Please refer to extravasation section.

The pH of OxyNorm® injection is 4.5 - 5.5.^(9b) Please refer to extravasation section.

OTHER COMMENTS:

1. Oxycodone is a controlled drug.^(1a-c)
2. Approximately 2mg of oral oxycodone is equivalent to 1mg of parenteral oxycodone. (Note that inter-patient variability requires that each patient is carefully titrated to the appropriate dose).^(1a-c)

REFERENCES:

1. Summary of Product Characteristics
 - a) OxyNorm® (oxycodone hydrochloride 10mg in 1mL, solution for injection or infusion). Napp Pharmaceuticals Ltd. Last revised: September 2008
 - b) Oxycodone hydrochloride 10mg in 1mL. Solution for injection or infusion. Wockhardt UK Ltd. Last revised 07/05/2010
 - c) OxyNorm® (oxycodone hydrochloride 50mg in 1mL, solution for injection or infusion). Napp Pharmaceuticals Ltd. Last revised: 14/01/2009
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> 04/01/2012. Oxycodone. Last revised 20/08/2010.
3. American Hospital Formulary Service Drug Information" accessed via <http://www.medicinescomplete.com> 04/01/2012. Oxycodone. Last revised 27/10/2011
4. Trissel "Handbook on injectable drugs" 16th edition accessed via <http://www.medicinescomplete.com> on 04/01/2012. Oxycodone
5. British National Formulary No. 62, September 2011 via <http://www.bnf.org> on 04/01/2012. Oxycodone
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - 6a) British National Formulary for Children 2011-2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)

- a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
- 8. a) COSHH data sheet, Napp Pharmaceuticals Ltd. Date of preparation: 18/01/2012
b) COSHH data sheet, Wockhardt UK Ltd. Date of preparation: 18/01/2012
- 9. a) Drug company name: Wockhardt UK Ltd. Date contacted: 18/01/2012
b) Drug company name: Napp Pharmaceuticals Limited. Date contacted: 18/01/2012
- 10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 2 (NHS Lothian local amendment)

Intravenous

Vitamins B and C (Pabrinex I\V High Potency Injection)

MEDICINE NAME:

Vitamins B and C

TRADE NAME(S):

Pabrinex® I\V High Potency Injection

PRESENTATION OF MEDICINE:

Ampoule 1 contains thiamine hydrochloride 250mg, riboflavin (as phosphate sodium) 4mg and pyridoxine hydrochloride 50mg in 5mL

Ampoule 2 contains ascorbic acid 500mg, nicotinamide 160mg and anhydrous glucose 1g in 5mL.⁽¹⁾

METHOD OF ADMINISTRATION:

IV Infusion: After appropriate dilution of ampoules one and two infuse the required dose over 30 minutes.⁽¹⁾

The CHM recommends that intravenous administration should be by infusion to minimise adverse effects.⁽⁵⁾

IV injection: For a combined injection volume of not more than 10mL (e.g the contents of one 5mL ampoule number 1 and one 5mL ampoule number 2), the contents of the ampoules are drawn up into a syringe to mix them just before use, then injected slowly over a period of 10 minutes.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV infusion: Dilute the required dose of ampoules one and two with 50mL to 100mL sodium chloride 0.9% or glucose 5%.⁽¹⁾

STABILITY

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Repeated injections of high concentrations of vitamin B₁ (thiamine) may give rise to anaphylactic shock. Mild allergic reactions (such as sneezing or mild asthma) are warning signs that further injections may give rise to anaphylactic shock. Facilities for treating anaphylaxis **must** always be available.⁽¹⁾

Although potentially serious allergic adverse reactions may occur, this should not preclude the use of parenteral thiamine in patients where this route is required.⁽⁵⁾

EXTRAVASATION:

No specific guidance on extravasation - monitor patient and treat symptomatically.⁽⁹⁾

Follow BNF guidance for general treatment of extravasation.⁽⁹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusion fluids: Sodium chloride 0.9%, glucose 5%, glucose 4.3% and sodium chloride 0.18%,⁽¹⁾ compound sodium lactate (Hartmann's), glucose 5% with potassium 0.3%.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

No information⁽⁹⁾

SODIUM CONTENT (mmol):

Ampoule 1: 10.6 to 15.2micromols

Ampoule 2: 1.9 to 2.4mmols.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information available.⁽⁹⁾

pH:

Ampoule 1: pH 2.5 to 3.5

Ampoule 2: pH 6 to 7.⁽⁹⁾

OTHER COMMENTS:

1. Pabrinex does not contain latex as an excipient. However, operators wear latex gloves during the manufacture process.⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics, Pabrinex. Last revised 03 November 2010
2. Martindale accessed online via www.medicinescomplete.com July 2011
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com July 2011
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com July 2011
5. British National Formulary No. 61 March 2011
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2010-11
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer - not available
9. Drug company name: Archimedes Pharma UK Ltd
Date contacted: July 2011

Version 7 (NHS Lothian local amendment)

Intravenous

Pancuronium bromide

MEDICINE NAME:

Pancuronium bromide

TRADE NAME(S):

Pancuronium bromide (Hospira)

PRESENTATION OF MEDICINE:

Ampoules containing pancuronium bromide 4mg in 2mL ⁽¹⁾

METHOD OF ADMINISTRATION (adult):

IV injection ⁽¹⁾

Preferably administer via central venous access device to avoid potential venous irritation as the preparation has a low pH. ⁽¹⁰⁾ If this is not possible, use a freely running established IV infusion line into a large peripheral vein.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

IV injection: Administer undiluted ⁽¹⁾

FLUSHING:

Sodium chloride 0.9% or glucose 5% ⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypertension, tachycardia and arrhythmias may occur, this tends to be dose related. ⁽¹⁾⁽²⁾⁽³⁾

Anaphylactic reactions, bradycardia, bronchospasm, hypotension, cardiovascular collapse, transient rashes and wheezing have been recorded. ⁽¹⁾⁽²⁾⁽³⁾⁽⁵⁾

A burning sensation along the vein has been reported by conscious patients. ⁽³⁾

Excessive salivation may occur during light anaesthesia, particularly in children or when no parasympatholytic agent has been administered. ⁽³⁾

The half-life of pancuronium is prolonged in neonates, therefore neonates should receive postoperative intermittent positive pressure ventilation. ^(6a)

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to the low pH of pancuronium. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

Do not mix pancuronium with other solutions in the same syringe, as a change in pH can cause precipitation. ⁽¹⁾

Compatible with the following infusion fluids: Sodium chloride 0.9%, glucose 5%, sodium chloride 0.45% with glucose 5%. ⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

None ⁽⁸⁾

SODIUM CONTENT (mmol):

0.15mmol per mL ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Osmolality 338mOsm/kg ⁽⁴⁾

pH:

3.8 to 4.2 ⁽⁹⁾

OTHER COMMENTS:

1. Store at 2 to 8°C. ⁽¹⁾
2. Keep the container in the outer carton during storage. ⁽¹⁾
3. Do not freeze. ⁽¹⁾
4. Store away from light. ⁽²⁾⁽⁸⁾

REFERENCES:

1. Summary of Product Characteristics, Pancuronium bromide 2mg/mL injection, Hospira. Date of revision of text 11/08/2009
2. Martindale 'The Complete Drug Reference' 37th Edition, pg 2071-2
3. American Hospital Formulary Service Drug Information 2011 pg 1432-3
4. Trissel "Handbook on injectable drugs" 17th Edition accessed via <http://www.medicinescomplete.com> on 23/04/2013
5. British National Formulary No. 65, March 2013 pg 829-831
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 pg 469
a) British National Formulary for Children 2012-2013 pg 646-647
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by Hospira UK Ltd, 21/06/2002
9. Drug company name: Hospira. Date contacted: 29/04/2013
10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
11. University College London Hospitals 'Injectable medicines administration guide' 3rd Edition, pg 54-5, 261

Version 5

Intravenous

MEDICINE NAME:

Pantoprazole

Pantoprazole

TRADE NAME(S):

Protium IV

PRESENTATION OF MEDICINE:

Vials containing pantoprazole sodium sequehydrate 42.3mg equivalent to pantoprazole 40mg as a dry powder ⁽⁹⁾

METHOD OF ADMINISTRATION:

Recommended dose is 40mg daily

IV injection: over 2 minutes ⁽¹⁾⁽²⁾⁽⁹⁾

IV infusion: Reconstitute each 40mg vial and further dilute in 100mL sodium chloride 0.9% or glucose 5% and give over 15 minutes ⁽¹⁾⁽²⁾⁽⁹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute contents of vial with 10mL sodium chloride 0.9% ⁽¹⁾

If cloudiness or precipitation is observed in the reconstituted vial it should be discarded⁽¹⁾

DISPLACEMENT VALUE:

Negligible ⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

If necessary dilute with glucose 5% or sodium chloride 0.9%⁽¹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

Use infusion within 12 hours ⁽¹⁾.

FLUSHING:

Glucose 5% ⁽¹⁾, glucose 10% ⁽⁵⁾, sodium chloride 0.9% ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Thrombophlebitis, peripheral oedema ⁽¹⁾. Monitor patients for adverse effects such as pruritis and skin rash.⁽¹⁾

EXTRAVASATION:

The reconstituted solution is highly basic so if extravasation occurs it is likely to cause tissue damage, leading to necrosis in the worst case. If extravasation occurs refer to local treatment policies. The extravasation can only be treated symptomatically so must be observed closely for signs of necrosis. If this happens, surgical treatment may be necessary ⁽⁹⁾.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Glucose 5% ⁽¹⁾, glucose 10% ⁽⁵⁾, sodium chloride 0.9% ⁽¹⁾

Incompatible: Acidic solutions ⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

No information ⁽⁸⁾

SODIUM CONTENT (mmol):

0.104mmol per vial ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Not determined ⁽⁹⁾

pH:

After reconstitution with 10mL sodium chloride 0.9% pH = 9-10 ⁽¹⁾

OTHER COMMENTS:

1. Rubber stoppers are latex free ⁽⁹⁾.
2. Due to extreme pH care should be taken to avoid extravasation when administering via a peripheral vein.

REFERENCES:

1. Summary of Product Characteristics last updated January 2008
2. Martindale "The Complete Drug Reference" 35th Edition
3. American Hospital Formulary Service Drug Information 2007
4. Trissel "Handbook on injectable drugs" 14th Edition
5. British National Formulary edition 54 September 2007
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
- a) British National Formulary for Children 2007
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
- a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer

9. Drug company name: Altana Pharma Ltd
Date contacted: 29/09/2006

Version 1 (NHS Lothian local amendment)

Intravenous

Paracetamol

Ensure that the dose given is appropriate for the age and weight of the patient.

There is a risk of accidental overdose, especially in infants and neonates.⁽¹¹⁾

Consider additional patient risk factors e.g. hepatotoxicity.⁽¹²⁾

MEDICINE NAME:

Paracetamol
(acetaminophen)

TRADE NAME(S):

Perfalgan®
Paracetamol (Fresenius Kabi Ltd)

PRESENTATION OF MEDICINE:

Vials containing paracetamol 500mg in 50mL (10mg in 1mL) solution for infusion.^(1a-b)

Vials containing paracetamol 1g in 100mL (10mg in 1mL) solution for infusion.^(1a-b)

Bags containing paracetamol 1g in 100mL (10mg in 1mL) solution for infusion.^(1a)

METHOD OF ADMINISTRATION:

IV infusion: Administer calculated dose over 15 minutes.⁽¹⁾

Adults over 50kg: Use the 10mg in 1mL, 100mL vial without further dilution.

Patients weighing more than 33kg and less than 50kg: Use the 10mg in 1mL, 100mL vial. Remove the excess solution from the vial before commencing administration of the calculated dose.⁽¹²⁾

Patients weighing more than 10kg and less than 33kg: Use the 10mg in 1mL, 50mL vial. Remove the excess solution from the vial before commencing administration of the calculated dose.⁽¹²⁾

Children less than 10kg: Withdraw the calculated dose from the 50mL vial into a syringe and administer it using a syringe pump after appropriate dilution.⁽¹²⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Adults and children over 10kg: The 10mg in 1mL solution for infusion is provided ready diluted for administration.⁽¹⁾

Children less than 10kg: Using a 5mL or 10mL syringe withdraw the required dose from the 50mL vial and dilute it to a minimum concentration of 1mg in 1mL with sodium chloride 0.9% or glucose 5%.⁽¹²⁾

The diluted solution should not be used in presence of opalescence, visible particulate matter or precipitate.⁽¹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

If paracetamol solution is further diluted expiry time is one hour.^(1a)

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypotension, hypersensitivity reactions, flushing, tachycardia, injection site reactions (pain and burning sensation).⁽¹⁾⁽⁵⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or infusions.⁽¹⁾

SODIUM CONTENT (mmol):

0.170mmol per 100mL vial (Perfalgan®).⁽⁹⁾

No information (Fresenius Kabi).⁽¹⁰⁾

OSMOLARITY / OSMOLALITY:

300 +/- 20mOsmol/L (Pefalgan®).⁽⁹⁾

280mOsmol/L (Fresenius Kabi).⁽¹⁰⁾

pH:

5.5 (Perfalgan®).⁽⁹⁾

5.0 to 7.0 (Fresenius Kabi).^(1b)

OTHER COMMENTS:

1. Do not store above 30°C.^(1a) Do not refrigerate or freeze.⁽¹⁾
2. Store the 100mL bags in the aluminium overpackaging. When the overpackaging is removed, use immediately.^(1a)
3. As for all solutions for infusion presented in glass vials, monitor closely notably at the end of the infusion. This applies particularly for central route infusion, in order to avoid air embolism.⁽¹⁾
4. Cases of accidental overdose have been reported during treatment with intravenous paracetamol in neonates, infants and individuals with low body weight. The MHRA has issued advice to help minimise the risk including recommended doses depending on patient weight.⁽¹¹⁾

REFERENCES:

1. Summary of Product Characteristics
 - a) Perfalgan®. Last revised 29/04/2010
 - b) Paracetamol (Fresenius Kabi). Last revised 10/12/2010
2. Martindale accessed via <http://www.medicinescomplete.com> on 02/02/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 02/02/2012
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 02/02/2012
5. British National Formulary No. 62, September 2011, pg 262
6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003

pg 470

a) British National Formulary for Children 2010-11 pg 254

7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#) pg 53
8. COSHH report compiled by the manufacturer Bristol-Myers Squibb. Date prepared 03/07/2005
9. Drug company name: Bristol Myers Squibb. Date contacted: 13/04/2011
10. Drug company name: Fresenius Kabi. Date contacted: 12/04/2011
11. Intravenous paracetamol (Perfalgan®); risk of accidental overdose, especially in infants and neonates. [MHRA Drug safety update, vol 3, issue 12, July 2010](#)
12. [Risk of accidental overdose with Perfalgan \(IV paracetamol\)](#)

Version 4

Intravenous

Pethidine hydrochloride

MEDICINE NAME:

Pethidine hydrochloride

TRADE NAME(S):

Generic (Goldshields plc)^(1a)
Generic (Martindale Pharma)^(1b)
Generic (Auden Mckenzie Ltd - Pharma Division)^(1c)

PRESENTATION OF MEDICINE:

Ampoules containing pethidine hydrochloride 100mg in 2mL, and 50mg in 1mL.^(1a-c)
Ampoules containing pethidine hydrochloride 100mg in 10mL and 50mg in 5mL.^(1c)

METHOD OF ADMINISTRATION:

IV injection: Dilute to 10mg per 1mL with sodium chloride 0.9%,⁽⁴⁾ glucose 5%⁽⁴⁾ or water for injections^(6a) and administer by a slow intravenous injection^{(1a)(1b)(1c)} i.e. over 2-5 minutes.^(6a)

IV infusion⁽⁴⁾ and **PCA**⁽²⁾ (unlicensed routes): 10mg/mL pethidine hydrochloride solution (e.g. 500mg in 50mL of sodium chloride 0.9% or glucose 5%) can be used for administration by a slow intravenous infusion via a syringe pump.⁽⁴⁾

Alternatively, a more dilute solution of pethidine for administration by a slow intravenous infusion can be used e.g. 1mg/1mL in 0.9% sodium chloride or 5% glucose.⁽⁴⁾ The usual adult dose range is 15-35mg/hour.⁽³⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Dilute with sodium chloride 0.9% or glucose 5%.⁽⁴⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours⁽²⁾

FLUSHING:

Sodium chloride 0.9% or glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

As with other strong opiate analgesics, severe respiratory depression, apnoea, hypotension, peripheral circulatory collapse, chest wall rigidity, cardiac arrest and anaphylactic shock may occur.⁽³⁾ Monitor blood pressure, heart and respiratory rate.

Have naloxone^(1a-c) and resuscitation equipment available. Naloxone is a short acting opioid antagonist and repeat doses or an infusion may be necessary in pethidine overdose.

EXTRAVASATION:

Should extravasation occur please refer to local extravasation policy.⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Dobutamine, glycopyrronium, hyoscine hydrobromide, metoclopramide, benzylpenicillin, bumetanide, cefuroxime, propofol, dopamine, hydrocortisone sodium succinate, metronidazole, ondansetron, potassium chloride, ranitidine.⁽⁴⁾

Incompatible: Phenytoin sodium, aminophylline, flucloxacillin, heparin sodium, morphine sulphate, sodium bicarbonate, pantoprazole, furosemide, aciclovir, imipenem (with cilastatin), barbiturates (e.g. thiopentone, phenobarbital).^{(1b)(4)}

SPECIAL HANDLING PRECAUTIONS:

No special requirements.

SODIUM CONTENT (mmol):

Negligible.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

1% 70.5mOsmol/L⁽¹¹⁾. See 1% link.

5% Undiluted:353mOsmol/L. Diluted: 309-317mOsmol/L⁽¹¹⁾. See 5% link.

pH:

4 to 6 (50mg/mL 1mL and 2mL injections).⁽⁹⁾

OTHER COMMENTS:

1. Patients receiving pethidine hydrochloride for longer than 48 hours or in total dosages exceeding 600mg over 24 hours are at increased risk of toxicity from the norpethidine metabolite. Such patients should be observed closely for potential manifestations of CNS stimulation (e.g. seizures, agitation, irritability, nervousness, tremors, twitches, myoclonus) associated with accumulation of the metabolite.⁽³⁾
2. Pethidine should only be used with caution and in reduced dosage in neonates and premature infants, elderly and debilitated patients and in patients with head injuries, severe hepatic or renal impairment, biliary tract disorders, hypothyroidism, adrenocortical insufficiency, shock, prostatic hypertrophy and supraventricular tachycardia as they are at particular risk of accumulation and/or toxicity of norpethidine.^(1a)

REFERENCES:

1. Summary of Product Characteristics
 - a) Goldshields plc, last revised 13/07/2009
 - b) Martindale Pharma, last revised June 2003
 - c) Auden Mckenzie (Pharma Division), last updated 09/07/2010
2. Martindale: The Complete Drug Reference. Accessed via <http://www.medicinescomplete.com> on 01/10/2010
3. American Hospital Formulary Service Drug Information. Accessed via

- <http://www.medicinescomplete.com> on 01/10/10
4. Trissel "Handbook on Injectable Drugs". Accessed via <http://www.medicinescomplete.com> on 04/10/2010
 5. British National Formulary No. 60
 6. Royal College of Paediatrics & Child Health 'Medicines for Children' 2003
a) BNF for Children 2010-11
 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
 8. COSHH report compiled by manufacturer; Goldshield plc
 9. Drug company name: Goldshield Pharmaceutical Ltd
Date contacted: 4th October 2010.
 10. www.extravasation.org
 11. Imperial College Healthcare NHS Trust, QA Department, January 2011

Version 1

Intravenous

Phenylephrine hydrochloride

MEDICINE NAME:

Phenylephrine hydrochloride

TRADE NAME(S):

Phenylephrine hydrochloride (Sovereign, Beacon)
Phenylephrine hydrochloride (as an NHS 'Special')

PRESENTATION OF MEDICINE:

Preparations which must always be diluted before administration:

Ampoules containing phenylephrine hydrochloride 10mg in 1mL (1%) (Beacon, Sovereign)

Ampoules containing 50mg in 5mL. NHS 'specials' manufacturers (unlicensed).

Preparations which can be administered without further dilution:

Ampoules containing 100micrograms in 1mL. Available in various volumes from NHS 'specials' manufacturers (unlicensed).

METHOD OF ADMINISTRATION:

Slow IV injection: Give by slow IV injection over 3 to 5 minutes.^(1a-b) The 10mg in 1mL preparation must be diluted before use.

IV infusion: Must be administered using a high performance infusion pump. When an IV infusion is discontinued, slow the infusion rate gradually; do not stop it abruptly.⁽³⁾

ADULTS: Give at a maximum rate of 180micrograms/minute. Adjust rate according to response.^{(1a-b)(2)}

CHILD (1-16 years): Unlicensed. Administer via a central venous access device at a rate of 100–500nanograms/kg/minute, adjusted according to response.^(6a)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Diluent: Glucose 5% or sodium chloride 0.9%^{(1a-b)(2)(3)(6a)}

The 10mg in 1mL preparation^(1a-b) must be diluted before use. The 100micrograms in 1mL preparation can be used without further dilution in adults but must be diluted before being given by IV infusion to children.

IV injection:

A commonly used concentration is 100micrograms in 1mL (10mg in 100mL). The maximum concentration for IV injection is 1mg/mL (10mg in 10mL). See 'OTHER COMMENTS' section for further information about dilution.

IV infusion:

ADULTS: A commonly used concentration is 100micrograms in 1mL (10mg in 100mL). However, the manufacturers^(1a-b) recommend diluting to 20micrograms in 1mL (10mg in 500mL).

CHILD (1-16 years) (unlicensed): Dilute to a concentration of 20micrograms in 1mL (10mg in 500mL).^(6a) See 'OTHER COMMENTS' section for further information about dilution.

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. May precipitate anginal pain in patients with angina pectoris.^(1a-b)
2. Increased blood pressure, tachycardia or reflex bradycardia.^(1a-b) Monitor blood pressure
3. Paraesthesia in the extremities.⁽³⁾

EXTRAVASATION:

May cause tissue necrosis.^{(1a-b)(2)(3)}

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

IV injection: When giving by IV injection do not administer via an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

IV infusion:

Compatible infusions (it is assumed that medicines meet close to the vascular access device): Amiodarone hydrochloride, anidulafungin (in glucose 5%), bivalirudin, caspofungin, cisatracurium (in glucose 5%), dexmedetomidine, doripenem, ethanol 10% in glucose 5%,⁽⁴⁾ Furosemide,⁽⁴⁾ levofloxacin (in glucose 5%), zidovudine (in glucose 5%)

Incompatible: Iron salts,^(1a-b) phenytoin,^(1a-b) and thiopental.⁽⁴⁾

SODIUM CONTENT (mmol):

Negligible^(9a-b)

pH:

4.5 to 6.5^(9a-b)

OTHER COMMENTS:

1. Phenylephrine hydrochloride is available from Sovereign Medical and Beacon Pharmaceuticals as a 10mg in 1mL injection. The Summary of Product Characteristics (SPC) for these preparations recommends that it is diluted before IV injection to a concentration of 1mg in 1mL (10mg in 10mL), and before IV infusion to a concentration of 20micrograms in 1mL (10mg in 500mL). However, this recommendation no longer reflects clinical practice. In practice, it is common to use a concentration of 100micrograms in 1mL for IV injection and some Centres also use this concentration for IV infusion in adults, adding 40mL to a 50mL Luer lock syringe to administer via an infusion pump. A number of NHS pharmaceutical manufacturing units make a 100micrograms in 1mL preparation (in 10mL, 20mL and 50mL volumes). See 'Pro-File' ('Current Suppliers' section) for further information.
2. Protect from light during storage.⁽¹⁾

3. Store at 2-25°C.

REFERENCES:

1. Summary of Product Characteristics
 - a) Phenylephrine, Sovereign Medical. Last revised May 2009
 - b) Phenylephrine, Beacon Pharmaceuticals. Last revised 03/03/2011/
2. Martindale accessed via <http://www.medicinescomplete.com> on 06/07/2011
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 04/10/2012
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 09/01/2013
5. British National Formulary No. 64, September 2012, pg 140, 991
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2012-2013 accessed via <http://www.bnfc.org> on 10/01/2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. Material Safety Data Sheet for phenylephrine. Boehringer Ingelheim. Version 3.3 revision date 20/05/2012
 - a) Material Safety Data Sheet for phenylephrine. Beacon Pharmaceuticals Ltd 28/02/2013
9.
 - a) Drug company name: Sovereign Medical (see Amdipharm). Date contacted: 25/01/2013
 - b) Drug company name: Beacon Pharmaceuticals. Date contacted: 23/01/2013

Version 5

Intravenous

Phenytoin sodium

CAUTION: Phenytoin is often administered as a loading dose followed by a maintenance dose. The doses are different.

MEDICINE NAME:

Phenytoin sodium

TRADE NAME(S):

Epanutin® Ready Mixed Parenteral
Generic (Hospira)(Mercury; supplier Amdipharm Mercury (Alliance)

PRESENTATION OF MEDICINE:

Ampoules containing phenytoin sodium 250mg in 5mL.⁽⁵⁾ Solution for injection or infusion.^(1a-d)

METHOD OF ADMINISTRATION (adult):

CAUTION: Phenytoin is often administered as a loading dose followed by a maintenance dose. The doses are different.

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a high pH.⁽¹²⁾

Slow IV injection: Administer slowly undiluted.^(1a-d)

ADULT: Maximum rate 50mg per minute.^(1a-d)

CHILD and NEONATE: In status epilepticus administer at a maximum rate of 1mg/kg/minute (maximum 50mg/minute).^(6a)

IV infusion: Because of the low solubility of phenytoin and the possibility of precipitation occurring when diluted, administration by intravenous infusion following dilution is not usually recommended.⁽²⁾⁽⁴⁾

Administer via an infusion pump. If diluted give through an in-line filter (0.22 to 0.5micron).^(1a-d)

ADULT: Maximum rate 50mg per minute.^(1a-d)

CHILD and NEONATE: 1mg/kg/minute (maximum of 50mg/minute).^{(2)(6a)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

IV injection: Further dilution not required.^(1a-d)

IV infusion: If local practice is to dilute the dose required before administration, dilute to 50-100mL with sodium chloride 0.9%. The final concentration should not exceed 10mg per 1mL.^(1a-d)

Administration, via an in-line filter (0.22 to 0.5micron) should commence immediately after the mixture has been prepared and must be completed within one hour.^(1a-d)

STABILITY

Prepare immediately before administration.

FLUSHING:

Flush with sodium chloride 0.9% before and after administration of phenytoin to avoid local venous irritation due to alkalinity of the solution.^(1a-d)

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

Rapid administration may result in hypotension and CNS depression.^(1a-d)

Depression of atrial and ventricular conduction and ventricular fibrillation, respiratory arrest and tonic clonic seizures reported particularly in gravely ill or elderly patients, if given too rapidly.^(1a-d) Soft tissue irritation and inflammation can occur at the site of injection even without extravasation of IV phenytoin.^(1a)

Monitoring:

Continuous ECG and blood pressure monitoring essential during infusion.^(1a-d) Cardiac resuscitative equipment should be available.^(1a-d)

Monitor patient for respiratory depression.^(1a-d)

Therapeutic drug level monitoring is required.^(1a-d)

EXTRAVASATION:

Extravasation will cause tissue damage due to high pH.^(1a-d) If extravasation occurs, refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

IV Infusion: Do not infuse or mix phenytoin with any other medicines as precipitation or crystallisation may occur.^(1a-d)

SPECIAL HANDLING PRECAUTIONS:

Wear good quality latex gloves. If solution accidentally comes into contact with skin, remove contaminated clothing, including footwear. Wash affected skin thoroughly with soap and water. If irritation persists or signs of toxicity occur, seek medical help.⁽⁸⁾

If solution accidentally splashed in eyes, hold eyes open and wash with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical help.⁽⁸⁾

Phenytoin is carcinogenic in mice and rats. It is a possible carcinogen to humans.⁽⁸⁾

SODIUM CONTENT (mmol):

1.1mmol sodium per 5mL ampoule (Pfizer product).^(1a)

0.91mmol sodium per 5mL (Hospira product)^(9a)

0.00013mmol sodium per 5mL ampoule (Mercury Pharma product).^(9d)

0.349mmol sodium per 5mL (Alliance product).^(9b)

OSMOLARITY / OSMOLALITY:

500mg in 100mL of sodium chloride 0.9% = 312mOsm/kg^{(9a)(11)}

pH:

pH of undiluted product: 11.2 to 12.1.^(9a-d)

pH of diluted product:⁽¹¹⁾

100mg in 10mL sodium chloride 0.9%: 10.4

1g in 250mL sodium chloride 0.9%: 10.1

OTHER COMMENTS:

1. Do not refrigerate solution as a precipitate may form. This is reversible on allowing the

solution to reach room temperature. The solution is suitable for use as long as it remains free from haziness and precipitate.^{(1a-d)(4)}

2. Protect from light during storage.^(1a-d)

3. **Excipients:** ampoule contains:

- Propylene glycol. Risk of accumulation in neonates and patients with renal failure.

Systemic toxicity includes CNS depression, hepatic or renal impairment, seizures, coma and arrhythmias.⁽²⁾

- Ethanol (approximately 96% per 5mL ampoule). This may be harmful to those suffering from alcoholism and should be taken into account in pregnant or breast-feeding women, children and high-risk groups such as patients with liver disease.^(1a)

REFERENCES:

1. Summary of Product Characteristics
 - a) Epanutin Ready Made Parenteral (Pfizer), last updated September 2012
 - b) Phenytoin (Hospira) last updated November 2012
 - c) Phenytoin (Mercury Pharmaceuticals (Supplier Amdipharm Mercury), last updated June 2012
 - d) Phenytoin (Alliance Pharmaceuticals) last updated April 2012
2. Martindale "The Complete Drug Reference" 36th Edition accessed via <http://www.medicinescomplete.com> on 13/07/2013
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 13/07/2013
4. Trissel "Handbook on Injectable Drugs" 15th Edition accessed via <http://www.medicinescomplete.com> on 13/07/2013
5. British National Formulary No 65 accessed via <http://www.bnf.org/bnf/> on 16/06/2013
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003 pg 491
 - a) British National Formulary for Children 2013-2014 accessed via <http://bnfc.org> on 05/07/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. Material Safety Data Sheet compiled by company - Hospira 14/01/2010
9.
 - a) Drug company name: Hospira. Date contacted: 12/07/2012
 - b) Drug company name: Alliance. Date contacted: 12/07/2012
 - c) Drug company name: Pfizer. Date contacted: 05/07/2012
 - d) Drug company name: Mercury Pharma. Date contacted:
10. www.accessabilitybybard.co.uk accessed 16/10/07
11. Information supplied by Imperial College Healthcare NHS Trust QA Department.
12. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 6 (NHS Lothian local amendment)

Intravenous

Phosphate Polyfusor/Freeflex

MEDICINE NAME:

Phosphates for Intravenous infusion

TRADE NAME(S):

Phosphate Polyfusor® NA/Freeflex® (Fresenius Kabi Ltd.)

PRESENTATION OF MEDICINE:

500mL polyethylene cylindrical container (Polyfusor®) or polyolefine bag (Freeflex®) containing:

phosphate 50mmol (100mmol/L),

sodium 81mmol (162mmol/L),

potassium 9.5mmol (19mmol/L).⁽¹⁾

METHOD OF ADMINISTRATION:

Intravenous infusion: Infusion must be given slowly (e.g. over 6-12 hours).⁽¹⁾

Not more than 15mmol phosphate per hour (150mL per hour phosphate infusion) should be given.⁽¹⁾⁽¹⁰⁾

A total maximum dose of 50mmol (500mL of phosphate solution) per infusion (per day) should not be exceeded.⁽¹⁾⁽²⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Provided ready diluted. Do not further dilute before use.⁽¹⁾

FLUSHING:

Sodium chloride 0.9%, glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Pain and phlebitis at the injection site may occur during intravenous administration.⁽¹⁾

Rapid infusion may be harmful⁽¹⁾ as it may lead to rapid changes in the concentration of serum electrolytes.

Monitor serum electrolytes (i.e. calcium, phosphate, potassium, sodium), renal function, fluid balance, acid-base balance, ECG, blood pressure.⁽¹⁾

EXTRAVASATION:

No information is available. Should extravasation occur please refer to local extravasation policy.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Esmolol, labetalol, sodium nitroprusside,⁽⁴⁾ potassium chloride.

Incompatible:

Magnesium and calcium salts.⁽¹⁾

Amiodarone and ciprofloxacin.⁽⁴⁾ Ringer's injection, lactated.⁽⁴⁾ In view of incompatibility with Ringer's injection, lactated, compound sodium lactate (Hartmann's solution) should be considered incompatible.

SODIUM CONTENT (mmol):

81mmol per 500mL Polyfusor container/Freeflex bag.⁽¹⁾

OSMOLARITY / OSMOLALITY:

281mOsmol/L ⁽¹⁾

pH:

7.0 to 7.7 ⁽¹⁾

OTHER COMMENTS:

1. Due to the potassium content, the solution should be administered with considerable care to patients with cardiac disease or conditions predisposing to hyperkalaemia such as renal or adrenocortical insufficiency, acute dehydration or extensive tissue destruction as occurs with severe burns.⁽¹⁾
2. Intravenous injections of potassium containing solutions should be given slowly as high blood concentrations may affect cardiac function. Potassium should generally not be given in the immediate postoperative period until urine flow is established.⁽¹⁾
3. Due to the sodium content, the solution should be administered with caution to patients with hypertension, cardiac failure, peripheral or pulmonary oedema, impaired renal function and pre-eclampsia.⁽¹⁾
4. In patients with renal impairment, the use of phosphate infusion must be carefully controlled by frequent determination of plasma electrolyte concentrations.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, updated August 2006, available from www.fresenius-kabi.co.uk
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com>, July 2010
3. American Hospital Formulary Service Drug Information" 2010 accessed via <http://www.medicinescomplete.com>, July 2010
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com>, July 2010
5. British National Formulary No. 59 accessed via <http://bnf.org/bnf/>
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 page 493
a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer (no report available for this product)
9. Drug company name: Fresenius-Kabi
Date contacted: July 2010
10. Charron T, Bernard F, Skrobik Y et al. Intravenous phosphate in the intensive care unit: more aggressive repletion regimes for moderate and severe hypophosphatemia. Intensive Care Med. 2003; 29;1273-1278.

Intravenous

Phytomenadione (Konakion MM)

MEDICINE NAME:

Phytomenadione
(Vitamin K₁)

TRADE NAME(S):

Konakion® MM

PRESENTATION OF MEDICINE:

Ampoules containing phytomenadione 10mg in 1mL in a mixed micelles vehicle.⁽¹⁾

METHOD OF ADMINISTRATION (adult):

IV infusion: Administer slowly over 20-30 minutes.⁽¹⁾⁽⁹⁾ May be injected into lower part of infusion apparatus.⁽¹⁾

IV injection: Give by slow IV injection⁽¹⁾ over at least 30 seconds, usually administered over 3-5 minutes.⁽⁹⁾ Doses should be measured using 0.5mL B Braun syringes.⁽⁹⁾ Alternatively if B Braun syringes are unavailable then give immediately after drawing up as excipients may interact with certain plastics.⁽¹⁰⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

Infusion: Dilute in 55mL of glucose 5%,⁽¹⁾ before slowly infusing the product.⁽¹⁾ 50mL infusion bag size is probably suitable.⁽⁹⁾⁽¹¹⁾ Do not dilute with other injectables.⁽¹⁾ Protect infusion and giving set from light.⁽¹⁾

IV injection: Can be given undiluted.⁽⁹⁾ However, to facilitate IV injection when volumes are very small, a larger volume of 10-20mL can be prepared by taking the required dose from the ampoule and diluting it, rather than diluting the whole 10mg and then taking the proportion needed. This will ensure the correct dose is given.⁽⁹⁾ The reason for this is that the mixed micelle formulation does not distribute evenly in the diluent and by administering a fraction of the diluent it could result in either under or over dosing.⁽⁹⁾

FLUSHING:

IV Injection: Flush with sodium chloride 0.9% or glucose 5%.⁽⁴⁾

IV Infusion: Flush with sodium chloride 0.9% or glucose 5%.⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Anaphylactoid reactions.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or infusions.⁽¹⁾

Compatible with the following infusions (it is assumed that infusions mix in the administration set close to the cannula insertion site): Ampicillin, epinephrine, heparin sodium, hydrocortisone sodium succinate, potassium chloride.⁽⁴⁾

Incompatible: Dobutamine.⁽⁴⁾

The following are usually incompatible, infuse separately if possible: Parenteral nutrition solutions, sodium bicarbonate infusions, phosphate preparations, blood components, plasma substitutes.

SODIUM CONTENT (mmol):

0.115mmol per 1mL ampoule ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

80mOsm/kg ⁽⁹⁾

pH:

5.3 to 6.6 ⁽⁹⁾

OTHER COMMENTS:

1. The mixed micelle formulation does not distribute evenly in the diluent and by administering a fraction of the diluent it could result in either under or over dosing.⁽⁹⁾ However, to facilitate IV injection, a larger volume of 10-20mL can be prepared by taking the required dose from the ampoule and diluting it, rather than diluting the whole 10mg and then taking the proportion needed. This will ensure the correct dose is given.⁽⁹⁾ (based on anecdotal reports from the company).
2. The solution should be freshly prepared and protected from light.⁽¹⁾
3. At the time of use, ampoule contents should be clear. If turbid do not use.⁽¹⁾
4. Excipients include glycocholic acid 54.6mg/ampoule, and lecithin.⁽¹⁾ When treating patients with severely impaired liver function it should be borne in mind that one Konakion MM ampoule 10mg/1mL contains 54.6mg glycocholic acid and this may have a bilirubin displacing effect.
5. The recommended maximum storage temperature is 25°C.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics. Konakion MM, last revised 07/08/2012
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 06/08/2013
3. American Hospital Formulary Service Drug Information Jan 2012
4. Trissel "Handbook on injectable drugs" 17th Edition, 2012, pg 948
5. British National Formulary No. 65, March 2013 pg 655
6. British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. Safety data sheet, Roche 19/12/2011
9. Drug company name: Roche
Date contacted: 20/01/2012, 14/12/2011; 13/10/2010; 25/02/2009; 29/12/2008; 03/06/2005
10. Medicines Policy, Charing Cross Hospital, 31/08/2006 [Phytomenadione Ref 10](#)
11. Baxter; Technical support brochure for IV Viaflo 01/05/2007 [Phytomenadione Ref 11](#)
Letter from Baxter on IV Viaflo 26Jan12 [Phytomenadione Ref 11](#)

Intravenous

Piperacillin with tazobactam

Contains a PENICILLIN.

From April 2012: Administration by slow intravenous injection is no longer recommended by the manufacturer.⁽¹¹⁾ The Lothian Antimicrobial Team have considered and support change to IV infusion in the inpatient setting.

MEDICINE NAME:

Piperacillin with
tazobactam

TRADE NAME(S):

Tazocin®

Generic (Actavis; Bowmed Ibisqus Ltd; Fresenius Kabi; Pfizer Ltd;
Sandoz Ltd; Stragen UK Ltd; Wockhardt UK)

PRESENTATION OF MEDICINE:

2.25g vial: containing 2g piperacillin and 250mg tazobactam (both as sodium salts) powder for reconstitution.^(1a-l)

4.5g vial: containing 4g piperacillin and 500mg tazobactam (both as sodium salts) powder for reconstitution.^(1a-l)

METHOD OF ADMINISTRATION (adult):

IV infusion: Infuse over 30 minutes.^(1a-l)

IV injection (unlicensed): This route of administration should ONLY be considered for patients who are fluid restricted or for the initial management of sepsis, the reconstituted solution can be given over 5 minutes.

This METHOD OF ADMINISTRATION (adult) is suitable for children

INSTRUCTIONS FOR RECONSTITUTION (adult):

Reconstitute each 2.25g vial with 10mL and each 4.5g vial with 20mL of either water for injections or sodium chloride 0.9%. Swirl until dissolved.^(1a-l)

INSTRUCTIONS FOR RECONSTITUTION (child):

CHILD and NEONATE

Taking into account the displacement value reconstitute each 2.25g vial to 10mL and each 4.5g vial to 20mL with either water for injections or sodium chloride 0.9%.^(1a-l) Swirl until dissolved.^(1a-l)

DISPLACEMENT VALUE:

1.5mL to 1.7mL per 2.25g vial
3mL and 3.5mL per 4.5g vial

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

IV infusion: Dilute the reconstituted solution to between 50 to 150mL with sodium chloride 0.9% or glucose 5%.^(1a-j)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (child):

CHILD AND NEONATE

IV infusion: Dilute the reconstituted solution to a concentration of 15 to 90mg/mL with sodium chloride 0.9% or glucose 5%.^(6a)

STABILITY

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Always check for previous hypersensitivity reactions to penicillins, cephalosporins and other allergens before starting therapy.

Anaphylaxis and other hypersensitivity reactions, including urticaria, fever, joint pains, rashes and, angioedema.

The combination of piperacillin and tazobactam and non-depolarising muscle relaxants can deepen and prolong neuromuscular blockade, which can be life-threatening.^(1a-j)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Generic piperacillin/ tazobactam products may have different compatibilities than Tazocin®, raising a risk of medication errors.⁽¹⁰⁾ Generic piperacillin/tazobactam must not be mixed or co-administered with any aminoglycoside. In circumstances where simultaneous administration of piperacillin/tazobactam and gentamicin or amikacin is thought to be essential Tazocin® has been shown to be compatible with specific concentrations of these antibiotics when given via a Y-site infusion only.^(1e)

Compatible infusions (it is assumed that the infusions meet close to the vascular access device): sodium chloride 0.9%, glucose 5%. The Tazocin® brand ONLY is compatible with sodium lactate, compound (Hartmann's).

Incompatible infusions (it is assumed that the infusions meet close to the vascular access device): sodium lactate, compound (Hartmann's) (all generic products) and sodium bicarbonate.

SODIUM CONTENT (mmol):

4.7 to 5.6mmol sodium per 2.25g vial

9.4 to 11.2mmol sodium per 4.5g vial

OSMOLARITY / OSMOLALITY:

Generic products: No information

Tazocin® 4.5g: 386mOsm/L to 927mOsm/L (dependent on dilution and diluent); see link

pH:

pH 5 to 7^(9e)

OTHER COMMENTS:

1. If water for injection is used as the diluent for preparing the infusion, the maximum recommended volume per dose is 50mL.
2. Store below 25°C and protect from light.

REFERENCES:

1. Summary of Product Characteristics
 - a) Piperacillin/Tazobactam 2g/0.25g powder for solution for injection or infusion, Fresenius Kabi, last revised April 2012
 - b) Piperacillin/Tazobactam 4g/0.5g powder for solution for injection or infusion. Fresenius Kabi, last revised April 2012
 - c) Piperacillin/Tazobactam 2g/0.25g powder for solution for injection or infusion, Wockhardt UK Ltd, last revised October 2012
 - d) Piperacillin/Tazobactam 4g/0.5g powder for solution for injection or infusion. Wockhardt UK Ltd, last revised October 2012
 - e) Tazocin 2g/0.25g and 4g/0.5g powder for solution for injection or infusion. Pfizer, last revised 19/09/2011
 - f) Piperacillin/Tazobactam 2g/0.25g powder for solution for injection or infusion. Bowmed Ibisqus Ltd (MAH: Ibigen Srl), last revised 20/04/2012
 - g) Piperacillin/Tazobactam 4g/0.5g powder for solution for injection or infusion. Bowmed Ibisqus Ltd (MAH: Ibigen Srl), last revised 20/04/2012
 - h) Piperacillin/Tazobactam, 1g/0.25g powder for solution for injection or infusion, Stragen UK Ltd, last revised 26/08/2011
 - i) Piperacillin/Tazobactam, 2g/0.25g powder for solution for injection or infusion, Stragen UK Ltd, last revised 26/08/2011
 - j) Piperacillin/Tazobactam 2g/0.25g and 4g/0.5g powder for solution for injection or infusion, Sandoz Ltd, last revised 19/09/2011
 - k) Piperacillin/Tazobactam 2g/0.25g powder for solution for injection or infusion, Actavis Ltd, last revised 07/10/2011
 - l) Piperacillin/Tazobactam 4g/0.5g powder for solution for injection or infusion. Actavis Ltd, last revised 07/10/2011
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com on 03/04/2013
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 06/01/2011
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com on 06/01/2011
5. British National Formulary No. 64 September 2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - 6a) British National Formulary for Children 2012-2013 accessed via <http://www.bnfc.org> January 2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by manufacturer
9. a) Drug company name: Fresenius Kabi. Date contacted: 20/05/2013
b) Drug company name: Actavis. Date contacted: 22/01/2013

- c) Drug company name: Wockhardt. Date contacted: 23/01/2013
- d) Drug company name: Pfizer. Date contacted: 22/01/2013
- e) Drug company name: Bowmed Ibisqus Ltd. Date contacted: 22/01/2013
- f) Drug company name: Sandoz. Date contacted: 22/01/2013
- g) Drug company name: Stragen. Date contacted: 22/01/2013
- 10. Medicines and Healthcare Products Regulatory Agency and the Commission on Human Medicines. Drug Safety Update January 2009, vol. 2; issue 6 accessed via <http://www.mhra.gov.uk/DrugSafetyUpdate/CON088141> on 17 June 2013
- 11. Quality Control Department, Charing Cross Hospital, Apr13

Version 4 (NHS Lothian local amendment)

Intravenous

Potassium chloride

MEDICINE NAME:

Potassium chloride

TRADE NAME(S):

PRESENTATION OF MEDICINE:

Ready-made "Diluted" infusion preparations which can be given via a peripheral venous catheter. The ready-made bags available in NHS Lothian include:

Ready-mixed 500ml infusion bags containing solution of potassium chloride 20mmol or 40mmol. Both strengths are available in glucose 5% IV infusion or sodium chloride 0.9% IV infusion.

Ready-mixed 500ml infusion bags containing a solution of potassium chloride 10mmol in glucose 10% IV infusion.

Ready-mixed bag containing a solution of potassium chloride 20mmol in glucose 5% and sodium chloride 0.45% (WGH only).

"Concentrated" ampoules which must be diluted prior to administration

Ampoules containing 2mmol/mL (15%) or 2.7mmol/mL (20%) potassium chloride in 5mL, 10mL or 20mL. **The use of concentrated potassium ampoules is to be avoided; ready made potassium chloride solutions should be used wherever possible.** Ampoules should be stored in a locked CD cupboard.⁽¹¹⁾

"Concentrated" infusion preparations which must be administered via a central venous access device

0.2mmol/mL:

Bag containing 20mmol in 100mL

0.4mmol/mL:

Prefilled syringe containing 20mmol potassium in 50mL

Vial containing 20mmol potassium in 50mL

Bag containing 40mmol in 100mL

1mmol/mL:

Prefilled syringe containing 50mmol potassium in 50mL.

The concentrated preparations listed above are available as an NHS 'Special'; contact your local Pharmacy department for further information.

METHOD OF ADMINISTRATION:

Adults: Infusion via a peripheral venous catheter. Use a ready made bag with a maximum concentration of 40mmol potassium per litre. Maximum infusion rate 20mmol per hour.⁽²⁾⁽³⁾

Adults: Infusion via a central venous access device. Concentrations greater than 40mmol per litre must always be given via a central venous access device, using a suitable infusion pump; ready made solutions should be used wherever possible.

Continuous ECG monitoring is required for administration rates above 20mmol per hour.⁽²⁾⁽³⁾

Paediatrics: Infusion via a peripheral line. The concentration of potassium should not exceed 40mmol/litre and given at a maximum rate of 0.2mmol/kg/hour.^(6a)

Paediatrics (PICU): Infusion via a central venous access device. Under specialist supervision with continuous ECG monitoring, "concentrated" potassium solutions are administered using a suitable infusion pump. Maximum infusion rate 0.5mmol/kg/hour.⁽¹³⁾⁽¹⁴⁾

Note: Glucose containing solutions may reduce serum potassium concentrations, so glucose-free solutions may be more suitable for initial IV therapy of hypokalaemia.⁽²⁾⁽⁵⁾

For information regarding the addition of potassium chloride to haemofiltration solutions, refer to Instructions for dilution and suitable diluent.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Always use ready-made infusion preparations. If under exceptional circumstances the concentrated ampoules need to be used to prepare an infusion, mix very thoroughly to avoid 'layering'.⁽⁵⁾

ADMINISTRATION VIA A PERIPHERAL VENOUS CATHETER:

Adults and paediatrics: Maximum concentration 40mmol potassium in 1litre.⁽¹¹⁾

ADMINISTRATION VIA A central venous access device OF CONCENTRATIONS EXCEEDING 40mmol per litre

Adults: Use ready-made 20mmol in 50mL potassium preparations or 50mmol in 50mL wherever possible.

Paediatrics (PICU): A concentration of either 0.5mmol/mL or 1mmol/mL potassium is usually used. Some centres use 0.4mmol/mL.⁽¹⁶⁾

ADDITION OF POTASSIUM CHLORIDE TO HAEMOFILTRATION REPLACEMENT FLUID BAGS

Adults: The addition of potassium chloride to haemofiltration replacement fluid bags which contain no potassium is a common practice within Critical Care. The patient's blood levels will equilibrate to the potassium concentration of the replacement fluid. An addition of 20mmol of potassium chloride to 5 litres of replacement fluid would result in a potassium concentration of 4mmol/litre, therefore the patient blood levels will equilibrate to 4mmol/litre. If 40mmol of potassium chloride were added to a 5 litre bag, this would result in a potassium concentration of 8mmol/litre which the patient would equilibrate to. For this reason do not add any more than 20mmol of potassium chloride to the manufactured 5 litre bags and do not add any potassium chloride to haemofiltration solutions which already contain potassium.

Paediatrics: Usual maximum concentration of haemofiltration fluid is 5mmol/L.⁽¹⁵⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Continuous ECG monitoring is essential for infusion rates exceeding 20mmol per hour, due to the risk of serious arrhythmias or cardiac arrest.⁽³⁾

Serum electrolytes must be monitored whilst patient is receiving intravenous potassium, to determine whether further infusions are required, and to avoid the development of hyperkalaemia, which is especially likely in renal impairment.⁽⁵⁾
Monitor blood glucose.⁽⁵⁾

Local pain or phlebitis may occur during IV administration, particularly at higher concentrations.⁽²⁾

Other adverse effects may be due to too rapid administration or too large a dose,⁽²⁾ e.g. ECG changes, paraesthesia, confusion and weakness.⁽³⁾

EXTRAVASATION:

Extravasation may cause tissue damage due to high osmolarity (more likely with higher concentrations).⁽¹²⁾ Administer via central venous access device or large peripheral vein. If extravasation occurs refer to local treatment policies.⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (It is assumed that medicines meet close to the vascular access device):

Potassium chloride 40mmol in 1000mL glucose 5% is compatible with: Aciclovir, adrenaline, aminophylline, amiodarone, ampicillin, calcium gluconate, ciprofloxacin, dexamethasone, digoxin, dobutamine, dopamine, esmolol, fentanyl, furosemide, insulin, isoprenaline, lignocaine, magnesium sulphate, meropenem, methylprednisolone sodium succinate, morphine sulphate, noradrenaline/norepinephrine, pantoprazole and zidovudine.⁽⁴⁾

Potassium chloride 40mmol in 1000mL sodium chloride 0.9% is compatible with:

Adrenaline, aminophylline, calcium gluconate, caspofungin, dexamethasone, digoxin, dopamine, fentanyl, furosemide, granisetron, insulin, lignocaine, magnesium sulphate, meropenem, methylprednisolone sodium succinate, morphine sulphate, norepinephrine/noradrenaline.⁽⁴⁾

Potassium chloride is incompatible with: Amphotericin, phenytoin.⁽⁴⁾ Potassium chloride diluted in sodium chloride is incompatible with amiodarone.

SODIUM CONTENT (mmol):

Nil

OSMOLARITY / OSMOLALITY:

4000mOsm/L as the 20mmol per 10mL ampoule.⁽⁴⁾

358mOsm/L as the 40mmol in glucose 5% 1litre bags.^(1a)

pH:

4-8⁽⁴⁾⁽⁹⁾

OTHER COMMENTS:

1. See NPSA guidance on the handling of potassium chloride concentrated solutions⁽¹¹⁾ (Document Ref: PSA01 Issued 23-07-2002) via 'Documents and Links' page.
2. March 2012 - See UKMi Q and A 'How should intravenous (IV) potassium chloride be administered in adults?'

REFERENCES:

1. Summary of Product Characteristics
 - a) Potassium Chloride 0.3% in glucose 5% 1litre, accessed via www.bbraun.co.uk last revised Sept 2003.
 - b) Potassium Chloride 0.3% in sodium chloride 0.9% 1litre www.BaxterHealthcare.co.uk, last revised 24/04/2003
2. Martindale accessed via www.medicinescomplete.com date accessed: 09/12/2010
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com date accessed: 09/12/2010
4. Trissel accessed via www.medicinescomplete.com date accessed: 09/12/2010
5. British National Formulary No. 60, September 2010 accessed via www.bnf.org
6. Medicines for Children 2003
 - a) British National Formulary for Children 2010-11 accessed via www.bnfc.org on 07/03/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9.
 - a) Drug company name: B Braun - not contacted
 - b) Drug company name: Baxter - not contacted
 - c) Drug company name: Goldshield - not contacted
 - e) Drug company name: hameln Pharmaceuticals Ltd - Jan 2011
10. National Extravasation Service accessed via www.extravasation.org.uk
11. NPSA Documents PSA01, issued 23/07/2002
12. BARD website accessed via www.accessabilitybybard.co.uk on 09/12/2010
13. Guy's and St. Thomas', Kings College and University Lewisham Hospitals Paediatric Formulary, 8th edition: revised September 2010
14. Neonatal Formulary, drugs used in pregnancy and the first year of life, 6th edition BMJ books. Edmund Hey 2011.
15. Birmingham Children's Hospital Injectable Medicines Guide, June 2011.
16. Survey carried out by Rhian Isaac on behalf of the PICUP SIG (PICU pharmacist special interest group of the Neonatal and Paediatric Pharmacist Group) in 2010.

Version 4 (NHS Lothian local amendment)

Intravenous

Procyclidine hydrochloride

MEDICINE NAME:

Procyclidine hydrochloride

TRADE NAME(S):

Kemadrin®

PRESENTATION OF MEDICINE:

Ampoules containing 10mg in 2mL⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: Give the undiluted solution as a slow IV injection over 3-5 minutes

STABILITY

Prepare immediately before use.

FLUSHING:

Sodium chloride 0.9%⁽¹⁰⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Possible infusion-related adverse events include dry mouth, blurred vision, nausea, vomiting, tachycardia, dizziness⁽¹⁾

EXTRAVASATION:

No information available⁽⁹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

SPECIAL HANDLING PRECAUTIONS:

Avoid contact with eyes, skin and clothing. Avoid breathing dust or mist.⁽⁸⁾

SODIUM CONTENT (mmol):

No information available⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information available⁽⁹⁾

pH:

pH 5.0 to 6.5 (in a 1% solution)⁽⁸⁾

REFERENCES:

1. Summary of Product Characteristics, Kemadrin®, date of 1st authorisation April 2003
2. Martindale "The Complete Drug Reference" 36th Edition pg 815

3. American Hospital Formulary Service Drug Information 2004 pg 1197
4. Trissel "Handbook on Injectable Drugs" 15th Edition
5. British National Formulary No. 60 September 2010, pg 305
6. Medicines for Children", the Royal College of Paediatrics & Child Health 2003, pg 521
a) British National Formulary for Children 2010-11 pg 297
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report, Auden McKenzie Ltd. Date of preparation 01/02/2009
9. Drug company name: Auden McKenzie Ltd
Date contacted: September 2010
10. Injectable Medicines Administration Guide 2nd Edition, 2007, pg 199. University College London Hospitals

Version 2

Intravenous

Propofol

**Do not confuse with Propofol-Lipuro®. See separate monograph.
Some of the information in this monograph is brand specific.**

MEDICINE NAME:

Propofol

TRADE NAME(S):

Diprivan®, Propoven®

PRESENTATION OF MEDICINE:

Diprivan® 1%:

Ampoules containing propofol 200mg in 20mL.^{(5)(9a)}

Pre-filled syringes containing propofol 500mg in 50mL.^{(5)(9a)}

Diprivan® 2%:

Pre-filled syringes containing propofol 1000mg in 50mL.^{(5)(9a)}

Propoven® 1%

Ampoules containing propofol 200mg in 20mL.^{(1c)(9b)}

Vials containing propofol 500mg in 50mL.^{(1c)(9b)}

Vials containing propofol 1000mg in 100mL.^{(1c)(9b)}

Propoven® 2%:

Vials containing propofol 1000mg in 50mL.^{(1d)(9b)}

METHOD OF ADMINISTRATION (adult):

IV injection:

Propofol 1%: Depending on indication, dose can be titrated and maintained by administering repeat IV injections according to patient response.^{(1a)(1c)}

Propofol 2%: Do not administer by IV injection.^{(1b)(1d)(2)}

IV infusion:

Administer using an infusion pump.^(1a-d)

Administer propofol 1% diluted (see below) or undiluted.^{(1a)(1c)}

Administer propofol 2% undiluted.^{(1b)(1d)}

Do not administer propofol via a microbiological filter.^{(1a-d)(5)(6a)}

For administration using the Diprifusor TCI system refer to the manufacturer's Summary of Product Characteristics.^{(1a)(1b)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

Propofol 1%: Administer undiluted or dilute to a concentration of not less than 2mg in 1mL.^{(1a)(1c)}

Diprivan® 1%: Dilute with glucose 5%.^(1a)

Propoven® 1%: Dilute with sodium chloride 0.9% or glucose 5%.^(1c)

Propofol 2%: Do not dilute propofol 2%.^{(1b)(1d)}

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

Diluted solutions: 6 hours.^{(1a)(1c)}

Undiluted solutions: 12 hours.^(1a-d)

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Bradycardia, hypotension, tachycardia, flushing, hyperventilation, apnoea, extraneous muscle movements, convulsions, cough, hiccup, thrombosis, phlebitis and anaphylaxis.^(1a-d)

Local pain on injection is very common and can be minimised by using larger veins of the forearm and antecubital fossa^(1a-d) or administering IV lidocaine prior to propofol.^(1c-d) Propofol 1% can be co-administered with preservative-free lidocaine.^{(1a)(1c)}

Monitoring: Monitor haemodynamic and respiratory function constantly.^(1a-d) Resuscitation facilities, including facilities for maintenance of a patent airway and artificial ventilation, should be readily available at all times.^(1a-d)

EXTRAVASATION:

Accidental clinical extravasation and animal studies showed minimal tissue reaction.^{(1a)(1b)} Local pain, swelling, blisters and/or tissue necrosis has been reported following extravasation.⁽³⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible with the following infusions (it is assumed that the infusions meet close to the vascular access device): Glucose 5%, sodium chloride 0.9%, glucose 4% with sodium chloride 0.18%.^(1a-d)

Compatible medicine containing infusions (it is assumed that medicines meet close to the vascular access device):

Diprivan® 1%: Alfentanil, cefotaxime (in glucose 5%), ceftriaxone (in glucose 5%), fentanyl, fluconazole (in glucose 5%), furosemide (in glucose 5%), hydrocortisone sodium succinate (in glucose 5%), insulin (in glucose 5%), magnesium sulfate (in glucose 5%), ranitidine (in glucose 5%).⁽⁴⁾

Diprivan® 2%, Propoven® 1% and 2%: Do not infuse with other medicines

Incompatible: Atracurium, mivacurium.^(1a-d) Amikacin, amphotericin, calcium chloride, ciprofloxacin, diazepam, digoxin, gentamicin, levofloxacin, methylprednisolone sodium succinate, metoclopramide, phenytoin, verapamil.⁽⁴⁾

SODIUM CONTENT (mmol):

Negligible^(1a-d)

OSMOLARITY / OSMOLALITY:

No information on the osmolarity or osmolality of Diprivan® 2%

pH:

6.0 to 8.5 (undiluted) ^{(9a)(9b)}

OTHER COMMENTS:

1. Diprivan® and Propoven® contain soya-bean oil; do not use in patients who are hypersensitive to peanut or soya. ^(1a-d)
2. Do not store above 25°C. Do not freeze. ^(1a-d)
3. Shake containers before use. If 2 layers can be seen after shaking, the emulsion should not be used. ^(1a-d)

REFERENCES:

1. Summary of Product Characteristics
 - a) Diprivan 1%, last revised 19/01/2012
 - b) Diprivan 2%, last revised 19/01/2012
 - c) Propoven 1%, last revised 04/2011
 - d) Propoven 2%, last revised 04/2011
2. Martindale accessed via www.thomsonhc.com on 19/04/2012
3. American Hospital Formulary Service Drug Information 2011 pg 2059-2068
4. Trissel 'Handbook on injectable drugs' 16th Edition 2010 pg 1335-1342
5. British National Formulary Number 63 accessed via www.medicinescomplete.com on 18/04/2012
6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003
 - a) British National Formulary for Children 2011-2012 accessed via www.medicinescomplete.com on 19/04/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#).
8. COSHH report compiled by AstraZeneca
Unable to obtain COSHH report from Fresenius Kabi
9.
 - a) Drug company name: AstraZeneca. Date contacted: 23/04/2012
 - b) Drug company name: Fresenius Kabi. Date contacted: 24/04/2012
10. Pharmacy QA Department, Charing Cross Hospital. Date contacted: 30/04/2012

Version 3

Intravenous

Protamine sulphate

MEDICINE NAME:

Protamine sulphate

TRADE NAME(S):

Prosulf®
Protamine (Sovereign Medical)

PRESENTATION OF MEDICINE:

Ampoules containing protamine sulphate 10mg in 1mL. Available as 5mL and 10mL ampoules.^{(1a)(1b)(5)}

METHOD OF ADMINISTRATION:

IV injection: Give undiluted by slow IV injection over 10 minutes. No more than 50mg should be administered in any 10 minute period. The rate should not exceed 5mg/minute.⁽³⁾⁽⁴⁾⁽⁵⁾

OR

IV infusion: Dilute dose required in sodium chloride 0.9% or glucose 5% and administer via an infusion pump. The rate should not exceed 5mg/minute.^{(1a)(4)(5)}

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Glucose 5% or sodium chloride 0.9% can be used to prepare an infusion of protamine sulphate. However, protamine sulphate is normally administered undiluted.⁽³⁾⁽⁴⁾

STABILITY

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.⁽⁴⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

After protamine injection a sudden fall in blood pressure, bradycardia, pulmonary and systemic hypertension, dyspnoea, transitory flushing and a feeling of warmth, back pain, nausea and vomiting, and lassitude have been observed. In excess, protamine sulphate itself can act as an anticoagulant. Patients undergoing prolonged procedures involving repeated doses of protamine sulphate should have clotting parameters closely monitored. Too rapid administration of protamine sulphate can cause severe hypotension and anaphylactoid reactions. Facilities for resuscitation and treatment of shock should be available. Patients should be carefully monitored using either the activated partial thromboplastin time or the activated coagulation time, carried out 5-15 minutes after protamine sulphate administration.^{(1a)(1b)(2)}

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to low pH. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

The manufacturer recommends that protamine sulphate not be mixed with other drugs unless their compatibility is known ⁽⁴⁾

Incompatible: Protamine sulphate is incompatible with certain antibiotics, including several penicillins and cephalosporins. ^(1a)

SPECIAL HANDLING PRECAUTIONS:

No information. ⁽⁸⁾

SODIUM CONTENT (mmol):

Trace amounts, as sodium hydroxide may be used to adjust the pH. ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

The osmolality of protamine sulphate (Lilly) 10mg/mL was determined to be 290mOsm/kg by freezing-point depression and 292mOsm/kg by vapour pressure ⁽⁴⁾

pH:

Ampoules 10mg in 1mL from 2.5 to 3.5 ⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics.
 - a) Protamine sulphate injection BP 1%. Date of revision of text August 2006. Sovereign Medical
 - b) Prosulf® 10mg/mL Solution for injection. Date of revision of text May 2008. Wockhardt Ltd
2. Martindale accessed via www.medicinescomplete.com. Date accessed August 2010
3. "American Hospital Formulary Service Drug Information" accessed via www.medicinescomplete.com, August 2010
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com, August 2010
5. British National Formulary No. 59 pg 143
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2010-11
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: UCB Pharma
Date contacted: 28/01/2009

Version 1 (NHS Local amendment)

Intravenous

Quinine dihydrochloride

UNLICENSED MEDICINE

Preferred route of administration: Intravenous Infusion

MEDICINE NAME:

Quinine dihydrochloride

TRADE NAME(S):

PRESENTATION OF MEDICINE:

Ampoules containing quinine dihydrochloride 300mg in 1mL.⁽⁵⁾⁽⁹⁾

Ampoules containing quinine dihydrochloride 600mg in 2mL.⁽⁵⁾⁽⁹⁾

Ampoules containing quinine dihydrochloride 300mg in 10mL (30mg/mL)⁽⁹⁾ Bottles containing quinine dihydrochloride 610mg in 500ml (quinine base 500mg in 500mL)⁽⁹⁾

METHOD OF ADMINISTRATION:

IV infusion: Administer using an infusion pump.

Loading dose (ADULT, CHILD and NEONATE): Infuse loading dose over 4 hours.^{(2)(5)(6a)}

In Intensive Care Units, a reduced loading dose can be administered over 30 minutes (see the BNF for further information).

N.B. A loading dose should not be given if the patient has received quinine (or quinidine) or mefloquine during the previous 12 hours.⁽⁵⁾

Maintenance doses (ADULT, CHILD and NEONATE): Infuse maintenance doses over 4 hours.^{(2)(5)(6a)}

Preferably administer via a central venous access device to avoid possible venous irritation as the preparation has a low pH.⁽¹⁰⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

ADULT: Dilute required dose to 250mL or 500mL with sodium chloride 0.9% or glucose 5%.^{(5)(6a)}

In fluid restriction can be diluted to a concentration not exceeding 30mg in 1mL.^(6a)

CHILD and NEONATE: Dilute to 2mg in 1mL (do not exceed 30mg in 1mL in fluid restriction).^(6a)

FLUSHING:

Flush with sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypoglycaemia; monitor blood glucose levels. Arrhythmias: atrial fibrillation; monitor ECG. Chinchonism including tinnitus, headache, confusion, nausea, abdominal pain and visual disturbances. Monitor electrolyte concentrations.

Fever and hypersensitivity reactions such as flushing of skin.⁽⁵⁾⁽¹¹⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to very low pH.⁽¹⁰⁾ If extravasation occurs, refer to local treatment policy.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or infusion fluids.

SODIUM CONTENT (mmol):

Nil

pH:

pH of 1.5-3.0 undiluted.⁽¹²⁾

OTHER COMMENTS:

1. Protect from light during storage.⁽²⁾
2. Administration by Slow IV infusion is less irritant than IM injection.⁽²⁾
3. A loading dose should not be used if the patient has received quinine (or quinidine) or mefloquine during the previous 12 hours.⁽⁵⁾

REFERENCES:

1. Summary of Product Characteristics (no SPC as unlicensed medicine)
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 23/04/2013
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 23/04/2013. No relevant information
4. Trissel "Handbook on injectable drugs". No relevant information
5. British National Formulary No. 65, March 2013 accessed via www.medicinescomplete.com on 23/04/2013
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 pg 541
a) British National Formulary for Children 2012-2013 accessed via www.medicinescomplete.com on 23/04/2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer - Unlicensed medicine
9. NHS Pro-File (password controlled); Availability of listed products confirmed 19/08/2013
10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
11. Drug Dex. Quinine monograph. Accessed via <http://thomsonhc.com/> on 24/04/2013
12. Quality Control Department, Charing Cross Hospital, May 2012

Intravenous

MEDICINE NAME:

Ranitidine (as hydrochloride)

Ranitidine

TRADE NAME(S):

Zantac®, Generic (Goldshield)

PRESENTATION OF MEDICINE:

Ampoules containing ranitidine 50mg in 2mL (as hydrochloride) ^{(1a)(1b)}

METHOD OF ADMINISTRATION:

IV Injection: Administer over a minimum of 2 minutes in adults ^{(1a)(1b)(2)(5)} or 3 minutes in children. ^(6a) A slower administration rate of over at least 5 minutes is recommended by some references ⁽³⁾⁽⁴⁾ because of the risk of causing bradycardia on administration. ⁽³⁾

IV Infusion over two hours: Maximum infusion rate for adults 25mg per hour. ^{(1a)(1b)(2)(5)}

Continuous IV Infusion:

In adults, give an initial 50mg IV Injection as above, followed by a continuous infusion at a rate of 125-250micrograms/kg/hour as a continuous infusion. ^{(1a)(1b)(2)(5)}

In children, administer at a rate of 125-250micrograms/kg/hour as a continuous infusion. ^{(1b)(6a)}

In neonates, (unlicensed) administer using an infusion pump at a rate of 30-60micrograms/kg/hour (maximum 3mg/kg daily). ^(6a)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV injection: Dilute 50mg to a volume of 20mL (or to a concentration of 2.5mg/mL ^(6a)) with a compatible infusion fluid ^{(1a)(1b)(3)(4)}

IV infusion over 2 hours : Add 50mg to 100mL of compatible infusion fluid ⁽³⁾⁽⁴⁾

Continuous IV Infusion: Dilute 150mg to a volume of 250mL with compatible infusion fluid ⁽³⁾⁽⁴⁾

Compatible Infusion Fluids:

Zantac® brand: Sodium chloride 0.9% or glucose 5% ^(1a)

Generic (Goldshield): Sodium chloride 0.9% ^(1b) or glucose 5% ^(9b)

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

Diluted ranitidine preparations should be discarded after 24 hours. ^(1a)

In terms of usage at higher ambient temperatures such as in neonatal units, ranitidine hydrochloride injection should be stored between 4 and 30°C and protected from light and excessive heat. Brief exposure to temperatures up to 40°C will not adversely affect the stability of the injection. ⁽⁴⁾

EXAMPLE CALCULATION:

Continuous Infusion rate: The infusion rate can be calculated from the following equation:

$$\text{Ranitidine infusion rate (mL/hour)} = \frac{\text{Dose (micrograms/kg/hour)} \times \text{patient weight (kg)}}{\text{Concentration (micrograms/mL)}}$$

Suggested Concentration: Dilute 150mg to 250mL with compatible infusion fluid to give a concentration of 150mg in 250mL (600micrograms in 1mL)

For example: For adults only, to administer a dose of 125micrograms/kg/hour of Ranitidine to a 70kg patient using a solution of 150mg in 250mL (600micrograms in 1mL), see the following calculation:

$$\text{Ranitidine infusion rate (mL/hour)} = \frac{125 \text{ (micrograms/kg/hour)} \times 70 \text{ (kg)}}{600 \text{ (micrograms/mL)}} = 14.6 \text{ mL/hour}$$

STABILITY

Prepare immediately before use.

FLUSHING:

Compatible infusion fluids: Sodium chloride 0.9%^{(1a)(1b)} or glucose 5%^{(1a)(9b)}
For children, flush with 3mL sodium chloride 0.9% over 5 minutes.^{(1a)(1b)}

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects may include bradycardia, atrioventricular block and cardiac arrhythmias.^{(1a)(1b)(2)(3)(5)} Cardiac arrest has been reported in patients undergoing ranitidine therapy. Caution is advised especially when administering intravenously to patients with cardiovascular disease.⁽²⁾ Rates of administration should not be exceeded.^(1b)

Other adverse effects caused by the administration of IV ranitidine include hypersensitivity reactions such as hypotension, bronchospasm, anaphylaxis, urticaria, chest pain, fever and angioneurotic oedema.^{(1a)(1b)(3)(5)}

EXTRAVASATION:

No information available. Refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

When giving by IV injection do not administer via an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after giving the IV injection.

Do not infuse with any other medicines or infusions.^(1b) There is no further information is available on the UK formulation.⁽⁴⁾

Incompatible: No further information is available on the UK formulation.⁽⁴⁾

Compatible diluents: Sodium bicarbonate 4.2%, compound sodium lactate (Hartmann's), sodium chloride 0.18% and glucose 4%,^(1a) glucose 5% in compound sodium chloride (Ringers), sodium chloride 0.45% and glucose 5%^(9b)

SPECIAL HANDLING PRECAUTIONS:

Handling of this product presents a minimal risk from occupational exposure. If the product contaminates the skin, using appropriate personal protective equipment, remove affected clothing. Flush exposed skin with large amounts of water. If skin reaction occurs, which may be delayed, seek medical advice. If the eyes are contaminated irrigate with clean flowing water for at least 15 minutes, seek medical attention. An eye wash station should be available in areas where the product is handled.⁽⁸⁾

If the product is spilt, wear appropriate protective clothing and use absorbent paper to soak up the spillage. Ranitidine must be disposed of as pharmaceutical waste.⁽⁸⁾

SODIUM CONTENT (mmol):

Zantac®: Sodium content 0.122mmol in 2mL (2.82mg)^(9a)

Generic: No information available^(9b)

OSMOLARITY / OSMOLALITY:

Zantac®:

50mg in 2mL undiluted = 248mOsm/L^(9a)

50mg in 2mL diluted to 20mL with distilled water = 26mOsm/L^(9a)

50mg in 2mL diluted to 20mL with sodium chloride 0.9% = 285mOsm/L^(9a)

Generic:

10mg in 1mL (water) = 59mOsm/Kg^(9b)

pH:

Zantac®: Undiluted 50mg in 2mL = pH 6.8 to 7.1^(9a)

Generic (Goldshield): Unbuffered solution pH 4.5 to 7.0, buffered solution pH 6.7 to 7.3^(9b)

OTHER COMMENTS:

1. Ranitidine hydrochloride 56mg in 2mL is equivalent to 50mg in 2mL of ranitidine base.⁽¹⁾
2. During storage protect ampoules from light and store below 25°C.^{(1a)(1b)} Do not freeze.^(1b)

REFERENCES:

1. Summary of Product Characteristics from eMC
 - a) GlaxoSmithKine Zantac® injection 50mg/2mL, updated 18 December 2008
 - b) Goldshield Pharmaceuticals, updated October 2009
2. Martindale accessed via <http://www.medicinescomplete.com> on 03/02/2009
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 26/01/2009
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 03/02/2009
5. British National Formulary No. 58 pg 46-7 and pg 877
6. Medicines for Children produced by the Royal College of Paediatrics and Child Health 2003 pg 546-7
 - a) British National Formulary for Children 2009 pg 61

7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. a) Drug company name: GlaxoSmithKline
Date contacted: 28th October 2004
Correspondence on file
b) Drug company name: Goldshield
Date contacted: 06/05/2009

Version 3 (NHS Lothian local amendment)

Intravenous

Rasburicase

MEDICINE NAME:

Rasburicase

TRADE NAME(S):

Fasturtec®

PRESENTATION OF MEDICINE:

Vial containing rasburicase 1.5mg powder. Plus ampoule containing 1mL solvent for reconstitution.⁽¹⁾

Vial containing rasburicase 7.5mg powder. Plus ampoule containing 5mL solvent for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION:

IV infusion: Administer over 30minutes.⁽¹⁾⁽³⁾

Do not administer by IV injection.⁽¹⁾⁽³⁾

INSTRUCTIONS FOR RECONSTITUTION:

Add the content of one ampoule of solvent provided to one vial of rasburicase to obtain a solution of 1.5mg in 1mL, and mix by swirling very gently. Do not shake.⁽¹⁾⁽³⁾

Requires further dilution before administration.⁽¹⁾

DISPLACEMENT VALUE:

None ⁽¹⁾⁽¹¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Dilute the reconstituted solution to 50mL with sodium chloride 0.9%.

The concentration of the final solution will depend on the dose required since the final volume must always be 50mL.⁽¹⁾⁽³⁾

STABILITY

Prepare immediately before use.

FLUSHING:

Sodium chloride 0.9% ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypersensitivity reactions including rash and rarely bronchospasm and anaphylaxis have occurred.⁽¹⁾ If this occurs rasburicase must be stopped immediately and permanently discontinued. Resuscitation facilities should be available.⁽¹⁾⁽⁵⁾

EXTRAVASATION:

No special precautions

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

(It is assumed that medicines meet close to the vascular access device):

Compatible: Do not infuse with any other medicines or infusions.⁽¹⁾

Rasburicase must not be mixed with other medicinal products including chemotherapeutic agents and should always be infused through a different line whenever possible.⁽¹⁾

Incompatible: Glucose solutions.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

Avoid breathing powder and contact with skin, eyes and clothing.⁽⁸⁾

SODIUM CONTENT (mmol):

Maximum of 0.1mmol in 1.5mg vial ⁽⁹⁾

Maximum of 0.46mmol in 7.5mg vial ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Osmolarity = 320mOsm/kg ⁽⁹⁾

pH:

Rasburicase 1.5mg and 7.5mg (reconstituted vials): 7.7 to 8.3 ⁽⁹⁾

OTHER COMMENTS:

1. Store unused vials of Fasturtec® at 2-8°C.⁽¹⁾ Do not freeze.
2. Do not use an in-line filter when infusing rasburicase.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Fasturtec®, Sanofi-Aventis, last updated 02/06/2009
2. Martindale accessed via www.medicinescomplete.com/mc/ on 28/09/2010
3. American Hospital Formulary Service Drug Information accessed via <http://www.medscape.com/> on 28/09/2010
4. Trissel "Handbook in injectable drugs" accessed via <http://www.medicinescomplete.com/mc/> on 28/09/2010
5. British National Formulary No. 60 accessed via <http://www.bnf.org/bnf/> on 28/09/2010
6. Royal College of Paediatric & Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2010-11 accessed via <http://www.bmfc.org/bnfc> on 28/09/2010
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. Material Safety Data Sheet, Rasburicase lyophilized powder. Revision date: 02/05/2003
9. Drug company name: Sanofi-Aventis. Date contacted: 28/09/2010 (personal correspondence)
10. Drugdex® accessed via <http://www.thomsonhc.com/> on 28/09/2010
11. UCL Hospitals Injectable Medicines Administration Guide, 2nd edition, 2007, pg205

Version 1 (NHS Lothian local amendment)

Intravenous

Rifampicin

MEDICINE NAME:

Rifampicin

TRADE NAME(S):

Rifadin for Infusion®

PRESENTATION OF MEDICINE:

Vial containing rifampicin 600mg powder. Plus 10mL ampoule containing water for injections for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION (adult):

IV infusion: Administer over 2 to 3 hours.⁽¹⁾

Fluid restriction (unlicensed): Give IV infusion over 30 minutes.⁽³⁾⁽⁴⁾

Do not administer by IV injection.

INSTRUCTIONS FOR RECONSTITUTION (adult):

Add 10mL of provided solvent to rifampicin powder and swirl gently to dissolve the vial contents.⁽⁴⁾ Further dilution is necessary before administration.⁽⁴⁾

DISPLACEMENT VALUE:

600mg displaces 0.48mL.⁽⁶⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

Suitable diluents: Sodium chloride 0.9% or glucose 5%.⁽¹⁾

After reconstitution dilute to a concentration of 1.2mg/mL⁽⁶⁾ e.g. add 600mg vial to 500mL of infusion fluid.⁽⁴⁾⁽⁵⁾

Fluid restriction: Dilute in 100mL of infusion fluid, providing a concentration of up to 6mg/mL.⁽⁴⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypersensitivity reactions, fever, skin rashes, nausea/vomiting, pain and phlebitis at the injection site, thrombophlebitis.⁽¹⁾

EXTRAVASATION

Extravasation can cause irritation and inflammation.⁽¹⁾ If extravasation occurs stop the infusion and restart at a different site.⁽¹⁾⁽³⁾ Refer to local policies for the treatment of extravasation.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or infusions.

SODIUM CONTENT (mmol):

Negligible

OSMOLARITY / OSMOLALITY:

No information available ⁽⁹⁾

pH:

pH 8.3 ⁽⁹⁾

OTHER COMMENTS:

1. Rifampicin causes a harmless orange-red discoloration of the urine, faeces, sweat, saliva, sputum, tears, and other body fluids. Soft contact lenses may become permanently stained.⁽¹⁾
2. Store Rifadin® vials below 25°C.⁽¹⁾
3. Rifadin® vials contain sodium formaldehyde sulfoxylate, a sulfite that may cause serious allergic type reactions in susceptible individuals e.g. atopic, non-asthmatic individuals.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics. Rifadin for Infusion 600mg®. Last updated 27/10/2011
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com 20/03/2013
3. American Hospital Formulary Service Drug Information
4. Trissel "Handbook on injectable drugs" 16th Edition 2010, pg 1374
5. British National Formulary No. 65, pg 383
6. British National Formulary for Children 2012-2013, pg 298
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by manufacturer. Not used as not available from the manufacturer
9. Drug company name: Sanofi. Date contacted: 20/03/2013 and 25/03/2013

Version 5

Intravenous

Sodium fusidate

MEDICINE NAME:

Sodium fusidate

TRADE NAME(S):

Sodium fusidate (Leo Laboratories)

PRESENTATION OF MEDICINE:

Vial containing sodium fusidate 500mg (equivalent to 480mg fusidic acid) powder.⁽¹⁾ Plus 10mL vial containing sterile phosphate-citrate buffer solution for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION:

IV Infusion: Preferably administer via a central venous access device over 2 hours or if not into a wide bore vein with good blood flow over at least 6 hours.⁽¹⁾ Leo Laboratories make no recommendation about using an infusion pump as long as the solution is infused over the required time period.⁽⁹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Dissolve the contents of one vial containing 500mg of sodium fusidate (equivalent to 480mg of fusidic acid) in the 10mL sterile phosphate-citrate buffer solution provided. Requires further dilution before administration.⁽¹⁾ The colour of the resulting reconstituted solution is colourless.⁽⁹⁾

DISPLACEMENT VALUE:

Negligible.⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

10mL of the reconstituted solution should be added to 500mL of diluent which may be sodium chloride 0.9% or glucose 5%.⁽¹⁾ The resulting reconstituted solution in the vial and the final diluted solution will both be colourless.⁽⁹⁾

There is no requirement to protect the infusion from light.⁽⁹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

The infusion expiry when prepared in a clinical area is 24 hours.⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Excessive doses may cause venospasm, thrombophlebitis and haemolysis of erythrocytes.⁽¹⁾ Reversible jaundice particularly with high doses, when infused too rapidly or at too high a concentration in the infusion fluid.⁽¹⁾ Thrombophlebitis, rarely skin rashes, and other allergic reactions including anaphylaxis.⁽¹⁾

EXTRAVASATION:

Extravasation may cause thrombophlebitis or tissue damage.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusion fluids: Compound sodium lactate intravenous infusion (Ringer-Lactate Solution, sodium lactate intravenous infusion), sodium chloride 0.18% and glucose 4% and potassium 0.3% and glucose 5% intravenous infusion.⁽¹⁾

Incompatible:- With infusion fluids containing 20% or more of glucose, lipid infusions and peritoneal dialysis fluids.⁽¹⁾

Precipitation may occur at dilutions which result in a pH of less than 7.4.⁽¹⁾

SODIUM CONTENT (mmol):

One 500mg vial when reconstituted with buffer solution provided contains 3.1mmols of sodium.⁽¹⁾

OSMOLARITY / OSMOLALITY:

The osmolality of the injection once reconstituted is 370mOsmol/kg.⁽⁹⁾

pH:

pH 7.4 to 7.6 after reconstitution with buffer.⁽¹⁾⁽¹⁰⁾

OTHER COMMENTS:

1. Store vials at room temperature below 25°C, protect from light during storage only. There is no requirement to protect the product from light during administration.⁽²⁾
2. The required amount of the sodium fusidate/buffer solution should be used once only and any unused portion discarded.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics. Sodium fusidate (Leo Laboratories), last revision of text 28/09/2011
2. Martindale "The Complete Drug Reference" accessed via <http://www.thomsonhc.com> on 18/03/2012
3. American Hospital Formulary Service Drug Information
4. Trissel "Handbook on injectable drugs" accessed via <http://www.thomsonhc.com> on 18/03/2012
5. British National Formulary accessed via <http://www.bnf.org/bnf> accessed 14/02/2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children accessed via <http://bnfc.org/bnfc/> on 14/02/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH data sheet, Leo Laboratories, version 3 11/11/2008
9. Drug company name: Leo Pharmaceuticals. Date contacted: 22/03/2011
10. QA Department, Charing Cross Hospital, 11/01/2012

Intravenous

Sodium nitroprusside

UNLICENSED MEDICINE

Important: The information in this monograph is brand specific. Check the brand used in your area, there may be differences in preparation, administration and storage.

MEDICINE NAME:

Sodium nitroprusside

TRADE NAME(S):

Nitropress®

PRESENTATION OF MEDICINE:

Vial containing sodium nitroprusside solution 50mg per 2mL.

METHOD OF ADMINISTRATION:

Continuous infusion: via a central venous access device using an infusion pump. The rate of administration should be adjusted to maintain the desired hypotensive effect, as determined by invasive arterial blood pressure monitoring.

Start with a very low rate of **0.3**micrograms/kg/minute and titrate up every few minutes until the desired effect is achieved or maximum recommended infusion rate of 10micrograms/kg/minute is reached. The average effective rate is about 3micrograms/kg/minute.

The infusion rate should not exceed 10micrograms/kg/minute in order to avoid excessive levels of cyanide and thiocyanate; lessen the chance of methemoglobinemia; and the possibility of a sudden drop in blood pressure.⁽¹⁾

If the response is unsatisfactory after 10 minutes at the maximum infusion rate, gradually decrease the infusion over 15-30 minutes to avoid an excessive rebound rise in blood pressure.⁽²⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Dilute the stock solution in 500-1000mL of glucose 5%, protect the infusion from light by using the opaque sleeve provided, aluminium foil or other opaque material. It is not necessary to cover the infusion drip chamber or the tubing.⁽¹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

Prepare immediately before use. If properly protected from light the prepared solution is stable for 24 hours.⁽¹⁾

EXAMPLE CALCULATION:

Usual adult dosage: 0.3-10micrograms/kg/minute titrated to response⁽¹⁾

Infusion rate: The infusion rate can be calculated from the following equation:

$$\text{Sodium nitroprusside infusion rate (mL/hour)} = \frac{\text{Dose (micrograms/kg/minute)} \times \text{patient weight (kg)} \times 60 \text{ (mins)}}{1,000 \times \text{concentration (mg/mL)}}$$

Example calculation table: See the package insert supplied in each package for example infusion rate table based on weight and concentration of the preparation.

FLUSHING:

Do not flush the giving set. After the infusion is discontinued, disconnect the giving set, aspirate the catheter contents and then flush with sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Severe hypotension. Nausea, sweating, dizziness, insomnia, headache, restlessness and muscle contractions can occur due to a rapid drop in blood pressure, which can be reduced when the rate of infusion is decreased or temporarily discontinued.⁽¹⁾ Blood pressure should be checked by invasive arterial blood pressure monitoring

In long term treatment, high doses and patients with kidney or liver damage, there may be an accumulation of cyanide or thiocyanate. Side effects of excessive thiocyanate include: tachycardia, sweating, hyperventilation, arrhythmias, marked metabolic acidosis (discontinue and give antidote).⁽⁵⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse sodium nitroprusside with any other medicine or infusion fluids.⁽¹⁾

SODIUM CONTENT (mmol):

0.3mmol per 50mg⁽⁴⁾

OSMOLARITY / OSMOLALITY:

303mOsmol/L 50mg in 50mL glucose 5%
281mOsmol/L 50mg in 500mL glucose 5%
279mOsmol/L 50mg in 1000mL glucose 5%
⁽¹¹⁾.

pH:

7.3 as a 50mg in 50mL glucose 5% solution
6.4 as a 50mg in 500mL glucose 5% solution
6 as a 50mg in 1000mL glucose 5% solution
⁽¹¹⁾.

OTHER COMMENTS:

1. Freshly prepared solution (in 500-1000mL) for infusion has a faint brownish tint. Do not use if highly coloured.⁽²⁾ The concentrated solution will be much darker.
2. During long term therapy monitor serum and blood cyanide levels and if more than 3 days, blood thiocyanate concentrations.⁽²⁾

REFERENCES:

1. Nitropress® manufacturer (Hospira USA) data in Package insert (August 2007).
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com on 04/06/2013.
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com

4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com on 04/06/2013
5. British National Formulary No. 65 accessed via www.BNF.org on 04/06/2013
6. Medicines for Children produced by the Royal College of Paediatric & Child Health 2003
 - a) British National Formulary for Children 2012-2013 accessed via www.BNFC.org on 04/06/2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by the manufacturer (not available)
9. Drug company name: not applicable
10. UKCPA Critical Care Group; Minimum infusion volumes for fluid restricted critically ill patients, 3rd edition 2006
11. IV Medusa Sodium Nitroprusside monograph for sodium nitroprusside. Accessed on 04/06/2013.

Version 1

Intravenous

Sodium stibogluconate

MEDICINE NAME:

Sodium stibogluconate

TRADE NAME(S):

Pentostam®

PRESENTATION OF MEDICINE:

Multidose vial containing sodium stibogluconate equivalent to 100mg pentavalent antimony in each mL.⁽¹⁾

METHOD OF ADMINISTRATION:

Due to high osmolality consider administration via a central venous access device.⁽¹⁴⁾

Slow IV injection: Filter immediately prior to injection by drawing up the dose through a sterile filter with a pore size of 5microns or less. Administer by slow IV injection over at least 5 minutes and preferably through a fine needle.⁽¹⁾

IV infusion (unlicensed): Give filtered dose in 100mL sodium chloride 0.9% over 30 minutes using a volumetric infusion pump.⁽¹⁰⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Infusion (unlicensed): Filter immediately prior to injection by drawing up the dose through a sterile filter with a pore size of 5microns or less.⁽¹⁾ Dilute dose to 100mL with sodium chloride 0.9%.⁽¹⁰⁾

STABILITY

Prepare immediately before use. Vial may be used for up to 1 month after first dose removed.⁽¹⁾

FLUSHING:

Sodium chloride 0.9%⁽¹⁰⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

Anaphylactic shock, nausea, vomiting, diarrhoea, myalgia, arthralgia, headache, QTc prolongation, fatal cardiac arrhythmias and other ECG changes, transient pain along the course of the vein, thrombosis, erythema, pruritis, coughing, substernal pain.⁽¹⁾

Monitoring:

ECG monitoring recommended prior to first dose and every three days during therapy. Where ECG monitoring is not available, the risks and benefits of therapy should be assessed on an individual basis. Discontinue sodium stibogluconate if clinically significant prolongation of QTc interval.⁽¹⁾ If coughing, vomiting or substernal pain occurs, discontinue treatment immediately.⁽¹⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to high osmolality and low pH.⁽⁸⁾⁽¹³⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

SODIUM CONTENT (mmol):

0.82mmol per mL⁽⁹⁾

OSMOLARITY / OSMOLALITY:

789mOsm/L.⁽¹³⁾

pH:

5.2 to 5.4⁽⁸⁾

OTHER COMMENTS:

1. Do not store the un-opened product above 25°C, protect from light and do not freeze.⁽¹⁾
2. After first use, label vial with patient's name and the date, store at or below 25°C protected from light, preferably in fridge and use within one month.⁽¹⁾⁽¹⁰⁾
3. Contains chlorocresol as preservative which has been associated with delayed irritant and hypersensitivity reactions when present in other injections.⁽¹⁾⁽¹²⁾
4. Sodium stibogluconate vials contain particulates caused by an interaction between the preservative and the antioxidant in the synthetic butyl rubber stopper. Use filters with membrane types polyvinylidene difluoride, polyethersulphone, polysulphone, nylon, surfactant-free cellulose acetate and mixed cellulose esters are suitable. Where filters unavailable, the risks and benefits of administering unfiltered sodium stibogluconate must be assessed by the clinician on an individual basis.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Pentostam® injection. Last revised 01/08/2007
2. Martindale "The Complete Drug Reference" accessed via www.thomson.com on 22/06/2011
3. American Hospital Formulary Service Drug Information accessed via www.medscape.org on 22/06/2011
4. Trissel "Handbook on injectable drugs" accessed via www.rpharms.com on 27/03/2012
5. British National Formulary No. 63 accessed via www.bnf.org/bnf on 27/03/2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 pg G48 and 578
 - a) British National Formulary for Children 2011-12 accessed via www.bnf.org/bnfc accessed 27/03/2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#) 24/06/2011
8. COSHH report compiled by manufacturer. MSDS for Pentostam Injection. Last reviewed 09/08/2006
9. Drug company name: GlaxoSmith Kline. Date contacted: 22/06/2011 and 27/03/2012
10. UCL Hospitals Injectable Medicines Administration Guide: Third Edition 2010
11. National Extravasation Service accessed via www.extravasation.org.uk on 24/06/2011

12. Rowe RC, Sheskey PJ, Quinn ME (Editors). Handbook of Pharmaceutical Excipients 6th Ed 2009
13. Berman JD, Grogg M, Leishmania Mediana: Chemistry and Biochemistry of Sodium Stibogluconate (Pentostam). Experimental Parasitology;67:96-103(1988) [See Link](#)
14. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 1 (NHS Lothian local amendment)

Intravenous

Sodium valproate (Epilim Intravenous)

DO NOT CONFUSE WITH EPISENTA BRAND. SEE DIFFERENT IV MONOGRAPH.

MEDICINE NAME:

Sodium valproate

TRADE NAME(S):

Epilim[®] Intravenous ⁽¹⁾

PRESENTATION OF MEDICINE:

Vials containing sodium valproate 400mg freeze-dried powder for reconstitution. Plus 4mL ampoule containing water for injections for reconstitution. ⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3-5 minutes. ^{(1)(2)(5)(6a)} The injection can be administered undiluted or diluted. ^{(6)(6a)(12)}

IV infusion: Administer over 60minutes in at least 50mL of compatible diluent or as a continuous infusion in an appropriate volume of compatible diluent. ⁽³⁾⁽⁴⁾

INSTRUCTIONS FOR RECONSTITUTION:

Reconstitute immediately prior to use. ⁽¹⁾

To reconstitute, inject the solvent provided (4mL water for injections) into the vial and allow to dissolve from which the appropriate dose should be extracted. ⁽¹⁾⁽⁹⁾

The concentration of reconstituted sodium valproate is 95mg/mL due to displacement of solvent by sodium valproate. ⁽¹⁾⁽⁶⁾⁽¹²⁾

DISPLACEMENT VALUE:

0.2mL/400mg ⁽¹⁾⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Sodium chloride 0.9% and glucose 5% ^{(1)(6a)(12)}

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours ⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%. ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects include nausea or dizziness which may occur a few minutes after the injection; they disappear spontaneously within a few minutes. Local injection site reactions, pain and inflammation have also been reported. Injection site pain, dizziness and taste perversion were reported more frequently when infused rapidly. ⁽¹⁾⁽³⁾

EXTRAVASATION:

No cases of extravasation have been reported.⁽¹⁰⁾⁽¹³⁾ Extravasation is unlikely due to the near neutral pH. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible with the following diluents in addition to those listed above: Sodium chloride and glucose intravenous infusion.^{(1)(6a)(12)}

IV injection: When giving by IV injection do not administer via an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

IV infusion: Do not infuse with any other medicines or infusions.⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

No information available ⁽⁸⁾⁽⁹⁾

SODIUM CONTENT (mmol):

2.4mmols per 400mg vial ⁽⁹⁾⁽¹²⁾

OSMOLARITY / OSMOLALITY:

No information available ⁽⁹⁾⁽¹¹⁾

pH:

6.8 to 8.5 ⁽⁹⁾

OTHER COMMENTS:

1. Epilim freeze-dried powder should be stored below 25°C.⁽¹⁾
2. The intravenous solution is suitable for infusion by PVC, polyethylene or glass container.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Epilim Intravenous injection. Text last revised 30 November 2009, accessed via eMC on 16/02/2010 www.emc.medicines.org.uk
2. Martindale accessed via www.medicinescomplete.com 21/12/2009
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 21/12/2009
4. Trissel "Handbook on Injectable Drugs" accessed via www.medicinescomplete.com on 21/12/2009
5. British National Formulary No. 58, September 2009, accessed via www.bnf.org/bnf/ 21/12/2009
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 pg 579 to 581
a) British National Formulary for Children 2009 accessed via <http://www.bnfc.org/bnfc> on 21/12/2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer Sanofi-Aventis accessed 21/12/2009
9. Drug company name: Sanofi-Aventis
Date contacted: 21/12/2009

10. National Extravasation Service, www.extravasation.org.uk. Accessed 21/12/2009
11. Bard website, www.accessabilitybybard.co.uk, accessed 21/12/2009
12. UCLH Injectable Medicines Administration Guide (2nd Edition) pg 220
13. Drug Analysis Prints-Valproic acid. Medicines & Healthcare products Regulatory Agency. Accessed via www.mhra.gov.uk on 21/12/2009

Version 1 (NHS Lothian local amendment)

Intravenous

Sodium valproate (Episenta)

DO NOT CONFUSE WITH EPILIUM BRAND. SEE OTHER IV MONOGRAPH.

MEDICINE NAME:

Sodium valproate

TRADE NAME(S):

Episenta® solution for injection ⁽¹⁾

PRESENTATION OF MEDICINE:

Glass ampoules containing sodium valproate 300mg in 3mL solution for injection. ⁽¹⁾

Glass ampoules containing sodium valproate 1000mg in 10mL solution for injection. ⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3-5 minutes. ^{(1)(2)(5)(6a)} The injection can be administered undiluted or diluted. ^{(6)(6a)(12)}

IV infusion: Administer over 60minutes in at least 50mL of compatible diluent, or as a continuous infusion in an appropriate volume of compatible diluent. ⁽³⁾⁽⁴⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Sodium chloride 0.9% or glucose 5% ⁽¹⁾

STABILITY

Prepare immediately before use. Discard any remaining infusion within 24 hours of preparation. ⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%. ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects include transient nausea or dizziness, local injection site reactions, pain and inflammation. Injection site pain, dizziness and taste perversion are reported more frequently when infused rapidly. ⁽¹⁾⁽³⁾

EXTRAVASATION:

No cases of extravasation have been reported. ⁽⁹⁾⁽¹⁰⁾ Extravasation is unlikely due to the near neutral pH. If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatibility information not available ⁽⁹⁾

IV injection: When giving by IV injection do not administer via an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

IV infusion: Do not infuse with any other medicines or infusions. ⁽¹⁾

SPECIAL HANDLING PRECAUTIONS:

Product is irritant to eyes and skin.⁽⁸⁾⁽⁹⁾

Eye contact: Flush with plenty of water.⁽⁸⁾

Skin contact: Wash with soap and water.⁽⁸⁾

SODIUM CONTENT (mmol):

1.8mmol per 3mL ampoule⁽⁹⁾

6.1mmol per 10mL ampoule⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information available⁽⁹⁾

pH:

7.4⁽⁹⁾

OTHER COMMENTS:

1. Prior to use, Episenta® solution for injection and the diluted solution should be visually inspected. Only clear solutions without particles should be used.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Episenta® solution for injection, text last revised 14/10/2008
2. Martindale accessed via www.medicinescomplete.com/mc/ 21/12/2009
3. American Hospital Formulary Service Drug Information 2009 accessed via www.medicinescomplete.com/mc/ 21/12/2009
4. Trissel "Handbook on Injectable Drugs" accessed via www.medicinescomplete.com/mc/ 21/12/2009
5. British National Formulary No. 58 September 2009, accessed via www.bnf.org/BNF/ 21/12/2009
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 pg 579-581
 - a) British National Formulary for Children 2009 accessed via <http://www.bnfc.org/bnfc> 21/12/2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer KATWIJK CHEMIE B.V. dated 31/01/2007
9. Drug company name: Beacon Pharmaceuticals
Date contacted: 22/12/2009
10. National Extravasation Service, www.extravasation.org.uk. Accessed 21/12/2009
11. Bard Website www.accessabilitybybard.co.uk accessed 21/12/2009
12. UCLH Injectable Medicines Administration Guide (2nd Edition) page 220

Version 1 (NHS Lothian local amendment)

Intravenous

Sugammadex

MEDICINE NAME:

Sugammadex

TRADE NAME(S):

Bridion®

PRESENTATION OF MEDICINE:

Vials containing sugammadex 200mg in 2mL (as sodium).⁽¹⁾
Vials containing sugammadex 500mg in 5mL (as sodium).⁽¹⁾
Clear and colourless to slightly yellow solution for injection.⁽¹⁾

METHOD OF ADMINISTRATION (adult):

ADULT

IV injection:⁽¹⁾

Give undiluted by rapid IV injection within 10 seconds directly into a vein or into an existing intravenous line for reversal of neuromuscular blockade induced by rocuronium or vecuronium.

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

ADULT

Give undiluted in adults.⁽¹⁾

FLUSHING:

Flush the infusion line adequately with sodium chloride 0.9% solution.⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Dysgeusia (metal or bitter taste), nausea, flushing, hypersensitivity reactions ranging from skin rash to fatal anaphylaxis,⁽¹⁾⁽²⁾ tachycardia and bradycardia⁽¹⁰⁾ and bronchospasm.⁽¹⁾⁽⁵⁾

Monitoring: Respiratory function and haemodynamic changes (all patients), APTT & prothrombin time (patients with pre-existing coagulopathies and those taking anticoagulation).⁽¹⁾⁽²⁾

EXTRAVASATION:

There is no specific information on management of extravasation with sugammadex, but should this occur it is not expected to cause tissue damage based on the pH and osmolality.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion. Flush the line both before and after giving the injection.

Compatible infusion fluids: Sodium chloride 0.9%, glucose 5 %, sodium chloride 0.45 % and glucose 2.5 %, Ringers lactate solution, Ringers solution, glucose 5 % in sodium chloride 0.9 %.⁽¹⁾

SODIUM CONTENT (mmol):

Each mL contains 0.42mmol sodium.⁽¹⁾⁽⁵⁾
Each 2mL vial contains 0.84mmol sodium
Each 5mL vial contains 2.1mmol sodium.

OSMOLARITY / OSMOLALITY:

Osmolality is between 300 and 500mOsm/kg.⁽¹⁾⁽⁹⁾

pH:

7 to 8.⁽¹⁾

OTHER COMMENTS:

1. The rubber stopper of the vial does not contain latex.⁽¹⁾
2. Store below 30°C. Do not freeze. Keep the vial in the outer carton in order to protect from light.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Bridion® 100mg/mL solution for injection. Date of revision of text 10/01/2013
2. Martindale accessed via <http://www.medicinescomplete.com> on 25/03/2013
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 25/03/2013
4. Trissel "Handbook on Injectable Drugs" 15th Edition accessed via <http://www.medicinescomplete.com> on 25/03/2013. No relevant information.
5. British National Formulary No. 65 January 2013 accessed via <http://bnf.org/bnf> on 25/03/2013
6. British National Formulary for Children March 2013 accessed via <http://bnfc.org/bnfc> on 25/03/2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#). No relevant information.
8. COSHH report (Bridion®) compiled by manufacturer. Unique code: SP498994. Date of last issue: 15/07/2011
9. Drug company name: Organon Laboratories Ltd. Date contacted: 06/11/2012
10. Drugdex Sugammadex. Accessed via <http://www.thomsonhc.com/home/dispatch> on 25/03/2013

Version 2

Intravenous

Tacrolimus

MEDICINE NAME:

Tacrolimus

TRADE NAME(S):

Prograf®

PRESENTATION OF MEDICINE:

Ampoules containing tacrolimus 5mg in 1mL concentrate for solution for infusion.⁽¹⁾

METHOD OF ADMINISTRATION:

IV infusion: Concentrate must be diluted and administered over 24 hours using an infusion pump.⁽¹⁾

Do not administer by IV bolus injection or as the undiluted concentrate.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Preferred method: Dilute the required dose to 48mL with glucose 5% or sodium chloride 0.9% and infuse at 2mL/hour over 24 hours. The final concentration should be 4-100micrograms/mL.⁽¹⁾

Tacrolimus is absorbed by PVC plastics. Tubing, syringes and any other equipment used to prepare and administer tacrolimus concentrate for solution should be made of polyethylene, polypropylene or glass.⁽¹⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours.⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9%, glucose 5%.⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypertension, tachycardia, dizziness, convulsions, headache, tremor, paraesthesia, diarrhoea, nausea, flatulence, bloating.⁽¹⁾ Allergic or anaphylactic reactions e.g. pruritis, rash. The risk can be reduced by slow infusion and prior administration of an antihistamine.⁽¹⁾ Monitor blood pressure, ECG.⁽¹⁾

EXTRAVASATION:

If extravasation occurs, refer to local treatment guidelines.⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible (it is assumed that medicines meet close to the vascular access device):

Aminophylline, amphotericin, anidulafungin, calcium gluconate, ceftazidime, ceftriaxone, cefuroxime, ciprofloxacin, clindamycin, dexamethasone sodium phosphate, digoxin, doxycycline, erythromycin, esmolol, fluconazole, furosemide, gentamicin, haloperidol, heparin, hydrocortisone, imipenem-cilastatin, lorazepam, methylprednisolone sodium succinate,

metronidazole, micafungin, morphine sulphate, potassium chloride, propranolol, ranitidine, tobramycin, vancomycin.⁽⁴⁾

Incompatible:

Aciclovir and ganciclovir.⁽¹⁾⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

If spillage occurs wear gloves and glasses to prevent skin and eye contact. Spillage should be disposed of as chemical waste. Tacrolimus solutions can be decomposed by treatment with alkali when the pH is kept at 12 or above.⁽⁸⁾

SODIUM CONTENT (mmol):

Negligible⁽⁹⁾

OSMOLARITY / OSMOLALITY:

A dilution of 1 in 50 (100micrograms/mL) gives 588mOsm/L.⁽⁹⁾

A dilution of 1 in 500 (10micrograms/mL) gives 320mOsm/L.⁽⁹⁾

pH:

When diluted between 4-100microgram per mL pH is 5.9-6.3.⁽⁹⁾

OTHER COMMENTS:

1. Contains polyoxyethylene hydrogenated castor oil, which may cause anaphylaxis.⁽¹⁾
2. Store ampoules at temperatures up to 25°C and protect from light.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Prograf®. Date of revision of text 13/07/2010
2. Martindale, 1st Quarter 2011 update, accessed via www.medicinescomplete.com on 27/01/2011
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 27/01/2011
4. Trissel "Handbook on injectable drugs" 15th Edition accessed via www.medicinescomplete.com on 27/01/2011
5. British National Formulary No. 60, September 2010 accessed via www.bnf.org on 27/01/2011
6. Royal College of Paediatrics & Child Health, Medicines for Children 2003
a) British National Formulary for Children 2010-11 accessed via www.bnfc.org on 27/01/2011
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. Material Safety Data Sheet compiled by the manufacturer; Astellas Pharma Ltd, 2008.
9. Drug company name: Astellas Pharma Ltd. Date contacted: August 2010
10. National Extravasation Service accessed via www.extravasation.org.uk

Intravenous

Teicoplanin

MEDICINE NAME:

Teicoplanin

TRADE NAME(S):

Targocid®

PRESENTATION OF MEDICINE:

Vials containing teicoplanin 200mg powder with ampoule of diluent (water for injections).⁽¹⁾

Vials containing teicoplanin 400mg powder with ampoule of diluent (water for injections).⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3-5 minutes.⁽¹⁾

IV infusion: Give doses less than 800mg over 30 minutes.⁽¹⁾ Give doses of 800mg and higher over 60 minutes.⁽⁹⁾

NEONATES:

IV infusion: Give over 30 minutes.

Do not administer by IV injection.⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Slowly add entire content of ampoule of water for injections to teicoplanin vial. Gently roll vial to dissolve teicoplanin. Avoid foam formation, do not shake vial. If solution becomes foamy allow to stand for 15 minutes to allow foam to subside.⁽¹⁾

DISPLACEMENT VALUE:

There is overage in the vial to account for displacement. When the powder is reconstituted with the ampoule of water for injections the final products contain teicoplanin 200mg in 3mL (200mg vials), 400mg in 3mL (400mg vials).⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Following reconstitution with water for injections may be further diluted with any suitable volume of sodium chloride 0.9% or glucose 5%.⁽¹⁾

STABILITY

Prepare immediately before use.

FLUSHING:

Sodium chloride 0.9%.

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Injection site irritation, nausea, vomiting, headache, dizziness, fever and rigors, hypersensitivity, anaphylaxis.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusion fluids: Glucose 4% with sodium chloride 0.18%, sodium lactate, compound (Hartmann's).⁽¹⁾

Incompatible: Aminoglycosides,⁽¹⁾ ciprofloxacin,⁽⁴⁾

SODIUM CONTENT (mmol):

200mg and 400mg vial - negligible.⁽⁵⁾

OSMOLARITY / OSMOLALITY:

No data available except, the calculated amount of salt added ensures that, when correctly reconstituted, the injection will have an osmolality close to that of body fluids.⁽⁹⁾

pH:

OTHER COMMENTS:

1. Store vials of dry teicoplanin in a dry place at temperatures of 25°C or below.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Targocid, last revised 03/04/2012
2. Martindale "The Complete Drug Reference" 36th Edition, accessed via www.medicines.org.uk on 01/03/2013
3. American Hospital Formulary Service Drug Information - no relevant information
4. Trissel "Handbook on injectable drugs" 13th Edition
5. British National Formulary No. 64 September 2012, accessed via www.bnf.or.uk on 01/03/2013
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2012-2013 accessed via www.bnfc.org.uk on 01/03/2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by Sanofi-Aventis not available
9. Drug company name: Sanofi-Aventis Ltd
Date contacted: 01/03/2013
10. QA Department Charing Cross Hospital, May 2013

Version 5 (NHS Lothian local amendment)

Intravenous

Tenecteplase

MEDICINE NAME:

Tenecteplase

TRADE NAME(S):

Metalyse®

PRESENTATION OF MEDICINE:

Vials containing:

Tenecteplase 8,000units (40mg)

Plus 8mL prefilled syringe contains 8mL water for injections.⁽¹⁾

Tenecteplase 10,000units (50mg)

Plus 10mL prefilled syringe contains 10mL water for injections.⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection Give as a bolus over approximately ten seconds.⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Add the complete volume of water for injections from the prefilled syringe to the vial. Swirl gently to avoid foaming.

The reconstituted preparation should be a colourless to pale yellow, clear solution.⁽¹⁾

DISPLACEMENT VALUE:

Approximately 0.5mL for both 40mg and 50mg vials.⁽⁹⁾

STABILITY

Prepare immediately before use.

FLUSHING:

Flush with sodium chloride 0.9%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: bleeding from recent puncture sites, haemorrhage at injection site, arrhythmias, anaphylactic reactions (including rash, urticaria, bronchospasm, laryngeal oedema).⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion. Flush the line both before and after giving the injection.

Incompatible: Do not administer in a line containing glucose.⁽¹⁾

SODIUM CONTENT (mmol):

Nil ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

260-320mOsm/Kg ⁽⁹⁾

pH:

7.0 to 7.6 ⁽⁹⁾

OTHER COMMENTS:

1. Contains a trace amount of gentamicin. Use with caution in individuals with known hypersensitivity to gentamicin.

REFERENCES:

1. Summary of Product Characteristics, Metalyse®. Date of last revision 04/06/2010
2. Martindale "The Complete Drug Reference" - no additional information
3. American Hospital Formulary Service Drug Information" - no additional information
4. Trissel "Handbook on injectable drugs" - no information
5. British National Formulary No. 63, March 2012 - no further information
6. a) Royal College of Paediatrics and Child Health "Medicines for Children" 2003
b) British National Formulary for Children 2011-2012 - no information
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Boehringer Ingelheim Ltd. Date contacted: 30/03/2012

Version 2 (NHS Lothian Local amendment)

Intravenous

Terlipressin acetate dry powder formulation

Important: Some information in this monograph is brand specific. Ensure you refer to the correct information for the brand in use in your Organisation.

MEDICINE NAME:

Terlipressin acetate

TRADE NAME(S):

Variquel® (Sinclair IS Pharma)

PRESENTATION OF MEDICINE:

Vial containing 1mg of terlipressin acetate as a powder. Plus 5mL ampoule containing solvent for reconstitution.⁽¹⁾

METHOD OF ADMINISTRATION (adult):

IV Injection: Give by slow IV injection over 1 minute.⁽¹⁾

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹⁰⁾

If a central venous access device is unavailable a risk benefit analysis should be made on an individual patient basis. If given peripherally, the insertion site must be monitored closely for phlebitis using a recognised infusion phlebitis scoring tool.⁽¹⁰⁾

INSTRUCTIONS FOR RECONSTITUTION (adult):

The entire contents of the solvent ampoule should be slowly added to the powder vial and the vial rolled gently until the powder is completely dissolved. The powder should dissolve within 10 seconds. A clear colourless solution results.⁽¹⁾

DISPLACEMENT VALUE:

Negligible⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

The reconstituted solution may be further diluted to 10mL with sodium chloride 0.9% solution for injection if required.⁽¹⁾

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

Use immediately after reconstitution.⁽¹⁾⁽⁹⁾

FLUSHING:

Flush with sodium chloride 0.9% w/v⁽⁹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

An acute hypertension rise has been reported in particular in patients suffering from hypertension.⁽¹⁾⁽⁶⁾ Abdominal cramps, headache and transient blanching/paleness. Other side-effects reported include nausea, diarrhoea, tremor and sweating.⁽¹⁾

Monitoring:

In principle the use of the product should be confined to specialist supervision in units with facilities for regular monitoring of the cardiovascular system, haematology and electrolytes.⁽¹⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to acidic pH (<5). If extravasation occurs, refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion. Flush the line both before and after giving the injection.

SODIUM CONTENT (mmol):

Any sodium content comes from the diluent and is less than 1mmol per 5mL.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Approximately 300mOsmol/L after reconstitution.⁽⁹⁾

pH:

The specification limits for the reconstituted product are a pH range of 4.5 to 7.0, with the usual figure being in the range pH 4.5 to 5.5.⁽⁹⁾

OTHER COMMENTS:

1. The vial closures are free from latex.⁽⁹⁾
2. Do not store above 25°C.⁽¹⁾
3. Keep the vial in the outer carton in order to protect from light.⁽¹⁾
4. The adverse effects of terlipressin have been likened to vasopressin, but less marked or milder.⁽¹⁾⁽²⁾⁽⁵⁾
The severe cardiac complications are well recognised. However, actual incidence may be low due to slow release of lysine-vasopressin from terlipressin and the relatively low doses used.⁽⁶⁾
5. Other side-effects include:- hypotension, peripheral ischemia, cyanosis, ventricular and supra-ventricular arrhythmias including 'Torsade de pointes', bradycardia, tachycardia, signs of ischemia on the ECG, angina, myocardial ischaemia and infarction, bronchospasm and respiratory arrest.

REFERENCES:

1. Summary of Product Characteristics Variquel®, last revised August 2010
2. Martindale accessed via MICROMEDEX Healthcare Series via www.micromedexsolutions.com on 13/07/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 13/07/2012 - not used
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 13/07/2012 - not used
5. British National Formulary No. 65 March 2013, pg 487

6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 pg 609-610
 - a) British National Formulary for Children 2012-2013 pg 390
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#) - not used
8. Safety Data Sheet Edition No. 6. Date of issue 04/04/2000. Compiled by Sinclair IS Pharma
9. Drug company name: Sinclair IS Pharma. Date contacted: 15/08/2012
10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 4

Intravenous

Terlipressin acetate solution for injection (Glypressin)

MEDICINE NAME:

Terlipressin acetate

TRADE NAME(S):

Glypressin® solution for injection (Ferring)

PRESENTATION OF MEDICINE:

Ampoules containing 1mg terlipressin acetate in 8.5mL solution for injection.⁽¹⁾

METHOD OF ADMINISTRATION:

IV injection: Give by slow IV injection over 3-5 minutes.

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹⁰⁾ If this is not possible, use a large peripheral vein after agreeing this route with a senior member of the medical staff.

STABILITY

Prepare immediately before use.

FLUSHING:

Sodium chloride 0.9% w/v ⁽⁹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

Increased arterial blood pressure, abdominal cramps, headache and transient blanching.⁽¹⁾

Other side-effects reported include angina, cardiac arrhythmias, nausea, tremor and sweating.

Monitoring:

Constant monitoring of blood pressure, serum sodium and potassium and fluid balance is essential.⁽¹⁾

EXTRAVASATION:

Extravasation is likely to cause tissue damage due to acidic pH (<5). If extravasation occurs, refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion. Flush the line both before and after giving the injection

SODIUM CONTENT (mmol):

1.3mmol ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Assumed to be isotonic ⁽⁹⁾

pH:

pH 3.5 to 4 ⁽⁹⁾

OTHER COMMENTS:

1. Store ampoules in a refrigerator (2-8°C).⁽¹⁾
2. Protect ampoules from light.⁽¹⁾
3. The adverse effects of terlipressin have been likened to vasopressin, but less marked or milder.^{(2)(5)(6a)}

The severe cardiac complications are well recognised. However, actual incidence may be low due to slow release of lysine-vasopressin from terlipressin and the relatively low doses used.⁽⁶⁾

REFERENCES:

1. Summary of Product Characteristics, Glypressin, Ferring Pharmaceuticals, last revised June 2011
2. Martindale accessed via MICROMEDEX Healthcare Series: Main Keyword Search on 13/07/2012
3. American Hospital Formulary Service Drug Information accessed via <http://www.medicinescomplete.com> on 13/07/2012 - not used
4. Trissel "Handbook on injectable drugs" accessed via <http://www.medicinescomplete.com> on 13/07/2012 - not used
5. British National Formulary No. 63 March 2012, pg 489-490
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003 pg 609-10
a) British National Formulary for Children 2012-2013 pg 390
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#) - not used
8. COSHH report compiled by manufacturer
9. Drug company name: Ferring Pharmaceuticals Ltd. Date contacted: 12/07/2012
10. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 2 (NHS Lothian local amendment)

Intravenous

Tetracosactide (tetracosactrin)

MEDICINE NAME:

Tetracosactide (tetracosactrin)

TRADE NAME(S):

Synacthen®

PRESENTATION OF MEDICINE:

Ampoules containing tetracosactide acetate 250micrograms in 1mL.⁽¹⁾

METHOD OF ADMINISTRATION (adult):

IV injection: Give by IV injection over 2 minutes⁽³⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

Sodium chloride 0.9%.⁽⁶⁾

For low dose test in children add 125micrograms to 500mL of sodium chloride 0.9% to give 1micrograms in 4mL.⁽⁶⁾ Invert the bag several times to ensure mixing then withdraw the required dose from the bag.⁽¹⁰⁾

FLUSHING:

Flush with sodium chloride 0.9%.⁽¹⁰⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

Hypersensitivity reactions including anaphylactic shock, skin reactions at the injection site, dizziness, nausea, vomiting, urticaria, pruritis, flushing, malaise, dyspnoea, angioneurotic oedema and Quinke's oedema.⁽¹⁾

Monitoring:

Hypersensitivity reactions tend to occur within 30 minutes of an injection.⁽¹⁾ Therefore monitor the patient during this time.⁽¹⁾

Tetracosactide should only be administered under the supervision of appropriate senior hospital medical staff.⁽¹⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give this medicine by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the IV injection.

Do not infuse with any other medicines.

SPECIAL HANDLING PRECAUTIONS:

Avoid contact with skin and eyes.⁽⁸⁾ In the event of spillage remove contaminated clothing immediately and wash off with soap and water.⁽⁸⁾ Eyes should be flushed with running water over several minutes.⁽⁸⁾

SODIUM CONTENT (mmol):

Negligible.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

289mOsm/L.⁽⁹⁾

pH:

3.8 to 4.5 ⁽⁹⁾

OTHER COMMENTS:

1. Store in a refrigerator (2-8°C).⁽¹⁾
2. Protect from light.⁽¹⁾
3. Shake well before use.⁽⁹⁾
4. Adrenaline and an IV corticosteroid should be prepared in advance and be available to combat any anaphylactic reaction.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Synacthen® ampoules 250micrograms (Alliance) last revised January 2011.
2. Martindale accessed via www.medicinescomplete.com on 08/06/2011.
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 08/06/2011.
4. Trissel "Handbook on injectable drugs" - not used.
5. British National Formulary No. 62, September 2011, pg 471.
6. Royal College of Paediatrics and Child Health 2003 "Medicines for Children" 2003 pg 616.
 - a) British National Formulary for Children 2011-2012, pg 382.
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#).
8. COSHH report compiled by manufacturer (23/08/2010).
9. Drug company name: Alliance Pharmaceuticals Ltd
Date contacted: 16/05/2011
10. UCL Hospitals Injectable Drug Administration Guide 2010, pg 315.
11. Drugdex via www.thomsonhc.com accessed 09/06/2011.

Version 4

Intravenous

Tobramycin

MEDICINE NAME:

Tobramycin

TRADE NAME(S):

Generic (Hospira UK Ltd)
Generic (TEVA UK)

PRESENTATION OF MEDICINE:

Vials containing tobramycin solution for injection 40mg in 1mL presented as:

40mg in 1mL^{(1a)(1b)}

80mg in 2mL^{(1a)(1b)}

240mg in 6mL^(1a)

METHOD OF ADMINISTRATION:

IV injection: Administer over 3 to 5 minutes.⁽⁹⁾

IV infusion: Administer required dose diluted to 50 to 100mL over 20 to 60 minutes.^{(1a)(1b)(2)(3)}

To avoid potential venous irritation preferably administer via a central venous access device as the preparation has a low pH.⁽¹¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Adults: The required dose of tobramycin may be diluted to volumes of 50 to 100mL with sodium chloride 0.9% or glucose 5% for adult doses.^{(1a)(1b)(5)}

Children: The volume of diluent should be proportionately less than for adults.^{(1a)(1b)(5)}

STABILITY

Prepare immediately before use. Discard within 24 hours of preparation.^(1a)

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%.^{(1a)(1b)}

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Tobramycin injection contains sodium metabisulphite^{(1a)(1b)} which may cause allergic-type reactions, including anaphylactic symptoms and life-threatening or less severe asthmatic episodes, in certain susceptible people. The overall prevalence of sulphite sensitivity in the general population is unknown and probably low, but it occurs more frequently in asthmatic patients.^(1a)

Administration related adverse effects include pain at injection site, fever, rash, itching, urticaria, nausea, vomiting, headache, lethargy,^{(1a)(1b)} mental confusion and disorientation.^(1a)

Peak and trough serum concentrations should be monitored. Evidence of impairment in renal, vestibular and/or auditory function requires discontinuation of the drug or dosage adjustment.^{(1a)(1b)}

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not give tobramycin by IV injection via a line being used for an infusion containing a medicine additive without first stopping the running infusion and flushing the line both before and after administering the injection.

Compatible (it is assumed that medicines meet close to the vascular access device):

Aciclovir, amiodarone, anidulifungin, aztreonam, bivalirudin, ciprofloxacin, cisatracurium, filgrastim, granisetron (all diluted in glucose 5%).⁽⁴⁾

Incompatible: Some penicillins and cephalosporins.^(1a) Amphotericin B cholesteryl sulphate complex, heparin sodium, propofol (all diluted in glucose 5%).⁽⁴⁾

SODIUM CONTENT (mmol):

0.026mmol/mL⁽⁹⁾

OSMOLARITY / OSMOLALITY:

TEVA brand:

The osmolality of 350mg tobramycin in 100mL glucose 5% has been calculated to be 338mOsmol/L.⁽¹⁰⁾

The osmolality of 350mg tobramycin in 100mL 0.9% sodium chloride has been calculated to be 368mOsmol/L⁽¹⁰⁾

There is no information on osmolality of Hospira brand.⁽⁹⁾

pH:

Injection: 4 (range 3.0 to 6.5)⁽⁹⁾

Infusion: in 100mL 0.9% sodium chloride: 4.8⁽¹⁰⁾
in 100mL glucose 5%: 4.8⁽¹⁰⁾

OTHER COMMENTS:

1. Store below 25°C, do not freeze, protect vials from light.^{(1a)(1b)(8)}

REFERENCES:

1. Summary of Product Characteristics
 - a) Tobramycin 40mg/mL injection (Hospira UK Ltd). Last updated on eMC 02/11/2011
 - b) Tobramycin injection BP 40mg/mL and 80mg/2mL (Medimpex). Date of last revision of text 13/10/2005
2. Martindale "The Complete Drugs Reference" accessed via www.medicinescomplete.com in August 2011
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com in August 2011
4. Trissel "Handbook on injectable drugs" 15th Edition accessed via www.medicinescomplete.com in August 2011
5. British National Formulary No. 61, March 2011
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-2012
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December](#)

[2011](#)

8. COSHH report compiled by manufacturer. Product Safety Data Sheet, Hospira UK Ltd.
Date of revision of text 12/02/2010
9. Drug company name: Hospira UK Ltd. Date contacted: 09/02/2012, 01/02/2012;
22/10/2010 and 11/10/2010
10. Imperial College Healthcare NHS Trust, QA department, Peter Cowin on 05/12/2010
11. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)

Version 2 (NHS Lothian local amendment)

Intravenous

Tramadol hydrochloride

MEDICINE NAME:

Tramadol hydrochloride

TRADE NAME(S):

Zydol[®], Zamadol[®]
Tramadol (Beacon Pharmaceuticals, Martindale Pharma)

PRESENTATION OF MEDICINE:

Ampoules containing tramadol hydrochloride 100mg in 2mL. ^(1a-d)

METHOD OF ADMINISTRATION (adult):

IV injection: Give by slow IV injection over 2-3 minutes. ^(1a-d)

IV infusion: Give at a rate appropriate to the volume selected e.g. give 50-100mL over 15-30 minutes. ⁽¹⁾

Patient controlled analgesia (PCA): Give up to 600mg over 24 hours with suitable lockout periods e.g. start at initial demand dose of 5mg with a lockout period of 5 minutes. ⁽¹¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

For administration via IV infusion or PCA, dilute with a suitable volume of diluent e.g. for PCA, dilute 500mg (10mL) up to 50mL to give a solution containing 10mg/mL. ⁽¹¹⁾

Suitable diluents for tramadol are sodium chloride 0.9% or glucose 5% ^{(1a)(1c)(4)(9d)}

Suitable diluent for Zamadol[®] is glucose 5% ^(1b)

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

24 hours ^(1a-d)

FLUSHING:

Flush with glucose 5% or sodium chloride 0.9% ^{(1a)(1c)(9b)(9d)}

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects: Nausea, vomiting, skin rashes, sweating, dizziness. Postural hypotension, palpitations, tachycardia, bradycardia, increase in blood pressure, cardiovascular collapse, convulsions, allergic reactions and anaphylactic shock, respiratory depression, hypoglycaemia.

Monitoring: Blood pressure, heart and respiratory rate.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusion fluids: Ringer's solution,^{(1a)(1c)(4)} sodium chloride 0.18% with glucose 4%,^{(1a)(1c)(4)} sodium lactate compound (Hartmann's).^(1a-c)

Incompatible: It is assumed that the medicines meet close to the vascular access device: Rifampicin.⁽⁴⁾

Incompatible: Precipitation will occur if mixed in the same syringe as diazepam, diclofenac, indometacin, midazolam or piroxicam,^(1a-c) and if mixed in the same bag as acyclovir or clindamycin.⁽⁴⁾

The following are usually incompatible, infuse separately if possible: Parenteral nutrition solutions, sodium bicarbonate infusions, phosphate preparations, blood components, plasma substitutes.

SODIUM CONTENT (mmol):

Negligible sodium per 2mL ampoule.^(9a-d)

OSMOLARITY / OSMOLALITY:

Zamadol[®]

Osmolarity: 280-320mOsmol/L.^(1b)

Zydol[®]

Osmolality: 340-400mOsmol/kg.^(9a)

Beacon Pharmaceuticals and Martindale Pharma

No information.^(9c-d)

pH:

pH 6 to 7^(9a-d)

OTHER COMMENTS:

1. Hypoglycaemia added as an adverse effect to reflect SPC changes in consultation with Manpreet. AW 07.01.14

REFERENCES:

1. Summary of Product Characteristics
 - a) Zydol[®] solution for injection. (Grunenthal Ltd). Text last revised 20/01/11
 - b) Zamadol[®] injection. (Meda Pharmaceuticals). Text last revised December 2009
 - c) Tramadol 50mg/mL solution for injection or infusion. (Beacon Pharmaceuticals). Text last revised 18/11/2012
 - d) Tramadol hydrochloride injection 50mg/mL (Martindale Pharma). Text last revised 02/08/2000
2. Martindale "The Complete Drug Reference" accessed via <http://www.medicinescomplete.com> 05/11/2012
3. American Hospital Formulary Service Drug Information 2011 accessed via <http://www.medicinescomplete.com> on 05/11/2012
4. Trissel "Handbook on Injectable Drugs" accessed via <http://www.medicinescomplete.com> on 05/11/2012

5. British National Formulary No. 64, March 2013, pg 282 and 1008
6. Royal College of Paediatrics & Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by manufacturer
9.
 - a) Drug company name: Grunenthal Ltd. Date contacted: 05/11/2012
 - b) Drug company name: Meda Pharmaceuticals. Date contacted: 19/11/2012
 - c) Drug company name: Beacon Pharmaceuticals. Date contacted: 21/11/2012
 - d) Drug company name: Martindale Pharma. Date contacted: 06/11/2012
10. Injectable Medicines Guide, UCLH, 3rd Edition, page 319
11. Injectable Medicines Guide, accessed via <http://www.medicinescomplete.com> on 30/08/2013

Version 3

Intravenous

Tranexamic acid

MEDICINE NAME:

Tranexamic acid

TRADE NAME(S):

Cyklokapron® Injection

PRESENTATION OF MEDICINE:

Ampoules containing tranexamic acid 500mg in 5mL⁽¹⁾

METHOD OF ADMINISTRATION:

ADULTS:

Slow IV injection: 500-1000mg over 5-10 minutes (1mL/minute).⁽¹⁾⁽⁵⁾

IV infusion (unlicensed): Give over at least 8 hours or until bleeding stops.⁽¹¹⁾⁽¹²⁾

CHILDREN 1 month-18 years:

IV injection: Give by slow IV injection over at least 10 minutes.^(6a)

IV infusion (unlicensed): Give over at least 8 hours or until bleeding stops.⁽¹²⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

IV injection: Give undiluted.⁽¹⁾

IV infusion: Dilute in a suitable volume in sodium chloride 0.9% or glucose 5%, e.g. dilute 1g or 2g to 100mL.⁽⁵⁾ N.B. RCPCH guidance recommends 500mg in 500mL.

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours.⁽⁹⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%⁽⁵⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Hypersensitivity reactions including anaphylaxis.

Rapid intravenous injection may cause dizziness and/or hypotension, with or without loss of consciousness.⁽¹⁾⁽⁵⁾

EXTRAVASATION:

No information⁽¹⁰⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusions (it is assumed that medicines meet close to the vascular access device): Glucose 5%, sodium chloride 0.9%.⁽¹²⁾

Incompatible: Do not infuse with any other medicines.

SODIUM CONTENT (mmol):

None.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

No information⁽⁹⁾

pH:

pH 6.5 to 8.0.⁽⁹⁾

OTHER COMMENTS:

1. Do not add tranexamic acid injection to blood transfusions.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics for Cyklokapron®. Text last revised November 2012
2. Martindale "The Complete Drug Reference" <http://www.medicinescomplete.com> accessed 28/09/2012
3. American Hospital Formulary Service Drug Information 2012. No relevant information.
4. Trissel "Handbook on injectable drugs" 16th Edition. No relevant information
5. British National Formulary No. 64, September 2012
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003. No relevant information
 - a) British National Formulary for Children 2012-2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Pfizer Ltd
Date contacted: October 2012
10. Extravasation website - www.extravasation.org.uk accessed 26/09/2012
11. NICE. ESUOM1 Significant haemorrhage following trauma: tranexamic acid. October 2012
12. Major trauma and the use of tranexamic acid in children; RCPCH Evidence Statement, November 2012

Version 4 (NHS Lothian local amendment)

Intravenous

Vancomycin

Important: Some information in this monograph is brand specific. Ensure you refer to the correct information for the brand used in your organisation.

SEE GUIDANCE ON USE OF VANCOMYCIN IN ADULTS ON THE NHS Lothian INTRANET

MEDICINE NAME:

Vancomycin

TRADE NAME(S):

Vancocin®
Vancomycin (Hospira UK Ltd)
Vancomycin (Wockhardt UK Ltd)
Vancomycin (Sandoz UK Ltd)
Vancomycin (Actavis UK Ltd)

PRESENTATION OF MEDICINE:

Vials containing vancomycin 500mg (as hydrochloride) powder for reconstitution.^(1a-e)
Vials containing vancomycin 1g (as hydrochloride) powder for reconstitution.^(1a-e)

METHOD OF ADMINISTRATION (adult):

IV infusion:

Administer as per [NHS Lothian Vancomycin Prescribing Guidelines in Adults](#). Maximum infusion rate of no more than 10mg/minute.

Continuous infusions (unlicensed indication for all brands except Hospira) are used in ITU only ([See ITU Guidelines](#)).

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a low pH.⁽¹¹⁾ If this device is unavailable, carry out a risk benefit analysis for the patient. If vancomycin is given peripherally, monitor the insertion site closely for phlebitis using a recognised infusion phlebitis scoring tool.⁽¹¹⁾ Rotate the insertion site regularly.^(1a-d) Concentrated solutions (greater than 5mg/mL) in fluid restricted patients should always be given via a central venous access device over 2 hours.^(6a)

INSTRUCTIONS FOR RECONSTITUTION (adult):

Reconstitute with water for injections. Add 10mL to a 500mg vial and 20mL to a 1g vial. This gives a 50mg in 1mL solution.

Dilute further before administration.^(1a-e)

DISPLACEMENT VALUE:

Vancocin® (Flynn): 500mg displaces 0.35mL, 1g displaces 0.7mL.^(9a)
Hospira: 500mg displaces 0.32mL, 1g displaces 0.65mL.^(9b)
Wockhardt: 500mg displaces 0.27mL, 1g displaces 0.54mL.^(9c)
Sandoz: 500mg displaces 1.5mL, 1g displaces 2.3mL.^(9d)
Actavis: negligible.^(9e)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

Use sodium chloride 0.9% or glucose 5%. Dilute each 500mg with at least 100mL to give a concentration of not more than 5mg in 1mL.

Intermittent IV infusion: Suggested dilutions:-

- 500mg - 1g in 250mL
- 1.25g - 1.5g in 500mL

Continuous IV infusion: Suggested dilutions:-

- 125mg – 500mg in 100mL
- 625mg – 1.25g in 250mL
- 1.5g – 2g in 500mL

Fluid restricted patients: A concentration of 10mg/mL can be used (e.g. 1g in 100mL) but must be given by a **central venous access device**.^(6a) The risk of infusion-related adverse effects may be increased.

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

24 hours.⁽¹³⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Rapid infusion may cause severe hypotension (including shock and cardiac arrest), wheezing, dyspnoea, urticaria, pruritus, flushing of the upper body ('red man' syndrome), pain and muscle spasm of back and chest.^(1a-e) Stop the infusion if they occur. A longer infusion time or premedication with an antihistamine may limit the reaction.

Peripheral administration may cause injection site pain and thrombophlebitis - rotate injection sites.⁽¹⁾

Monitoring: All patients require plasma vancomycin measurements.⁽⁵⁾ See local policy.

EXTRAVASATION:

May cause tissue damage ^(1a-d)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Compatible infusions (it is assumed that medicines meet close to the vascular access device): Aciclovir, amiodarone (in glucose 5%), clarithromycin, fluconazole, insulin, magnesium sulfate, meropenem, midazolam, morphine sulfate, tigecycline⁽⁴⁾

Compatible infusion fluids: Sodium chloride 0.9%, glucose 5%, glucose 5% in sodium chloride 0.9%, sodium lactate, compound (Hartmann's solution).^(1b)

Incompatible: Ampicillin, cefotaxime, ceftazidime, ceftriaxone, cefuroxime, foscarnet, heparin,

omeprazole, piperacillin/tazobactam, ticarcillin/clavulanate.⁽⁴⁾ Dexamethasone sodium phosphate, phenobarbital, sodium bicarbonate.^(1b)

Vancomycin solution has a low pH that may cause chemical or physical instability when it is mixed with other medicines^(1a-d)

Mixing with alkaline solutions should be avoided.^{(1a)(1b)(4)}

Always flush intravenous lines well between administration of vancomycin and beta-lactam antibiotics.

SODIUM CONTENT (mmol):

Nil ^(9a-c)

OSMOLARITY / OSMOLALITY:

Reconstituted solution (50mg in 1mL) = 57mOsm/kg ⁽⁴⁾

Diluted solution (5mg/mL) = 249mOsm/kg in glucose 5% and 291mOsm/kg in sodium chloride 0.9%. ⁽¹⁰⁾

pH:

Reconstituted solution (50mg/mL) = pH 2.5 to 4.5 ⁽¹⁰⁾

Diluted solution (2.5mg/mL or 5mg/mL) = pH 3.5 to 3.8. ⁽¹²⁾

OTHER COMMENTS:

1. Store at 28°C in original packaging. ⁽¹⁾
2. Scottish Antimicrobial Prescribing Group - [Guidance on Use of Gentamicin and Vancomycin in Adults](#)

REFERENCES:

1. Summary of Product Characteristics
 - a) Vancocin®, date of last revision of the text 23 October 2008 (Flynn)
 - b) Vancomycin hydrochloride 500mg and 1g Powder for Concentrate for Infusion, Hospira UK Ltd. Date of last revision of text January 2008
 - c) Vancomycin 500mg and 1g Powder for Solution for Infusion, Wockhardt UK Ltd. Date of first authorisation 04 April 2008
 - d) Vancomycin 500mg and 1g Powder for solution for infusion. Sandoz Ltd. Date of last revision of text, 03/06/2010
 - e) Vancomycin 500mg and 1g Powder for solution for infusion. Actavis Ltd. Date of last revision of text 02/07/2013
2. Martindale "The Complete Drug Reference" accessed via www.medicinescomplete.com on 10/05/2012
3. American Hospital Formulary Service Drug Information accessed via www.medicinescomplete.com on 10/05/2012
4. Trissel "Handbook on injectable drugs" accessed via www.medicinescomplete.com on 10/05/2012
5. British National Formulary No. 63 March 2012 pg 375
6. Medicines for Children produced by the Royal College of Paediatrics & Child Health 2003
 - a) British National Formulary for Children 2011-2012 pg 286
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines –](#)

November 2013 (updated January 2014)

8. COSHH report compiled by the manufacturer
 - a) Safety Data Sheet compiled by Hospira UK Ltd. Date of preparation 1 May 2002
 - b) Safety Data Sheet compiled by Flynn Pharma. Date of original issue: 30 September 2005
 - c) Safety Data Sheet compiled by Sandoz Ltd. Date of issue 03/12/2010
9.
 - a) Drug company Name: Flynn Pharma Ltd. Date contacted: 05 April 2012
 - b) Drug company name: Hospira UK Ltd. Date contacted: 11 April 2012
 - c) Drug company name: Wockhardt UK Ltd. Date contacted: 12 April 2012
 - Drug company name: Sandoz UK Ltd. Date contacted 15/04/2013
 - e) Drug company name: Actavis UK Ltd. Date contacted: 04/08/2013
10. Bard website www.accessability-by-bard.co.uk. Date accessed 10/05/2012
11. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
12. Peter Cowin, Pharmacy QA Department, Imperial College Healthcare, pH Measurement Oct12
13. Hospira Medicines information, In-house stability data (Enquiry reference number UK2012-01683), contacted 07/12/2012

Version 4 (NHS Lothian local amendment)

Intravenous

Iron sucrose (Venofer)

The MHRA issued updated advice (see 'Method of Administration' below) on administration and monitoring of intravenous iron preparations dated August 2013 which is included in this monograph but may not be reflected in the package insert.

MEDICINE NAME:

Iron sucrose

TRADE NAME(S):

Venofer®

PRESENTATION OF MEDICINE:

Vials containing iron 50mg in 2.5mL as iron sucrose (iron(III)-hydroxide sucrose complex)

Vials containing iron 100mg in 5mL as iron sucrose (iron(III)-hydroxide sucrose complex)

Ampoules containing iron 100mg in 5mL as iron sucrose (iron(III)-hydroxide sucrose complex).⁽¹⁾

METHOD OF ADMINISTRATION (adult):

Venofer® should only be administered when staff trained to evaluate and manage anaphylactic reactions are immediately available, in an environment where full resuscitation facilities can be assured.⁽¹⁾ Further information in link and adverse effects section below.

ADULT

Preferably administer via a central venous access device to avoid potential venous irritation as the preparation has a high pH.⁽⁸⁾

IV infusion via an infusion pump: Administer at an infusion rate of not more than 100mg over 15 minutes.⁽¹⁾

IV injection: Administer at a maximum rate of 20mg (1mL) per minute.

The total single dose must not exceed 200mg of iron sucrose given not more than three times a week. If the total necessary dose exceeds the maximum allowed single dose, then the administration has to be split.⁽¹⁾

Injection into dialyser: Iron sucrose may be administered during a haemodialysis session directly into the venous limb of the dialyser under the same procedures as those outlined for intravenous injection.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

ADULT

IV infusion:

Dilute each 2.5mL (50mg iron) in a maximum of 50mL of sodium chloride 0.9%.

Dilute each 5mL (100mg iron) in a maximum of 100mL of sodium chloride 0.9%.

Using volumes of more than 100mL for each 100mg iron may cause instability.⁽¹⁾

EXPIRY TIME TO WRITE ON THE 'MEDICINE ADDED' LABEL OF A CONTINUOUS INFUSION

Use ampoules immediately after opening. Administer immediately after dilution with sodium chloride 0.9%.⁽¹⁾

EXAMPLE CALCULATION (adult):

The patient's body weight and patient's most recent Hb level are used to determine dose of iron required. The dose for iron sucrose (Venofer®) must be individually determined for each patient according to the total iron deficit calculated with the formula in the attached link.⁽¹⁾

See information below for dose calculation for Venofer:

Total iron deficit (mg) = body weight (kg) x (target Hb – actual Hb (g/L) x 0.24* + depot iron (mg)

- Below 35kg body weight: target Hb = 130g/l and depot iron = 15mg/kg body weight
- 35kg body weight and above: target Hb = 150g/l and depot iron = 500mg

Factor 0.24* = 0.0034 x 0.07 x 1000 (iron content of haemoglobin 0.34%; Blood volume 7%

of body weight; Factor 1000 = conversion from g to mg)

The total amount of Venofer required is determined from either the above calculation or the following dosage table:

Body weight (kg)	Total number of ampoules of Venofer to be administered			
	Hb 60g/l	Hb 75g/l	Hb 90g/l	Hb 105g/l
30	9.5	8.5	7.5	6.5
35	12.5	11.5	10	9
40	13.5	12	11	9.5
45	15	13	11.5	10
50	16	14	12	10.5
55	17	15	13	11
60	18	16	13.5	11.5
65	19	16.5	14.5	12
70	20	17.5	15	12.5
75	21	18.5	16	13
80	22.5	19.5	16.5	13.5
85	23.5	20.5	17	14
90	24.5	21.5	18	14.5

To convert Hb (mM) to Hb (g/l), multiply the former by 16.1145

FLUSHING:

Sodium chloride 0.9% ⁽¹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Parenterally administered iron preparations can cause hypersensitivity reactions including serious and potentially fatal anaphylactic/anaphylactoid reactions. Hypersensitivity reactions have also been reported after previously uneventful doses of parenteral iron complexes.

The risk is enhanced for patients with known allergies including drug allergies, including patients with a history of severe asthma, eczema or other atopic allergy.

There is also an increased risk of hypersensitivity reactions to parenteral iron complexes in patients with immune or inflammatory conditions (e.g. systemic lupus erythematosus, rheumatoid arthritis).

Venofer® should only be administered when staff trained to evaluate and manage anaphylactic reactions is immediately available, in an environment where full resuscitation facilities can be assured.

Monitor patients carefully for signs and symptoms of hypersensitivity reactions during and following each administration of Venofer®. Each patient should be observed for adverse effects for at least 30 minutes following each Venofer® injection. If hypersensitivity reactions or signs of intolerance occur during administration, the treatment must be stopped immediately. Facilities for cardio respiratory resuscitation and equipment for handling acute anaphylactic/anaphylactoid reactions should be available, including an injectable 1:1000 adrenaline solution. Additional treatment with antihistamines and/or corticosteroids should be given as appropriate.⁽¹⁾

EXTRAVASATION:

Iron sucrose has the potential to cause tissue injury if extravasation occurs as pH >9.⁽¹⁾⁽⁹⁾ If extravasation occurs refer to local treatment policies.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or infusions, as potential for incompatibility and/or precipitation is high.⁽¹⁾⁽⁴⁾ Iron sucrose must only be mixed with sodium chloride 0.9%; do not use glucose 5%. The compatibility with containers other than glass, polyethylene and PVC is not known.⁽¹⁾

SODIUM CONTENT (mmol):

1.3mmol per 5mL of Venofer®.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

The osmolality of a solution of 5mL Venofer® diluted in 100mL of sodium chloride 0.9% was measured at 333mOsm/kg.⁽⁹⁾

pH:

pH 10.5 to 11.0⁽⁹⁾

OTHER COMMENTS:

1. Slow IV infusion is preferred route of administration, to reduce the risk of hypotensive episodes.

2. Paravenous leakage must be avoided as it can lead to pain, inflammation, tissue necrosis and brown discolouration of the skin.⁽¹⁾
3. Do not store above 25°C. Do not freeze.⁽¹⁾
4. Iron sucrose is not recommended for use in children.⁽¹⁾
5. The injection is contraindicated in patients with a history of asthma, eczema, anaphylaxis or other allergic disorders.⁽²⁾

REFERENCES:

1. Summary of Product Characteristics. Venofer®. Updated 09/2013
2. Martindale accessed via MedicinesComplete on 18/12/2013
3. American Hospital Formulary Service Drug Information accessed via MedicinesComplete on 18/12/2013
4. Trissel "Handbook on injectable drugs" 15th Edition accessed via MedicinesComplete on 18/12/2013
5. British National Formulary accessed via www.bnf.org on 18/12/2013
6. British National Formulary for Children accessed via www.bnfc.org on 18/12/2013
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)"
8. [Royal College of Nursing - Standards for infusion therapy - third edition - January 2010](#)
9. Drug company name: Vifor Pharma UK Ltd. Date contacted: 19/12/2013
10. Quality Assurance department, Charing Cross Hospital. July 2010.

Version 5 (NHS Lothian local amendment)

Intravenous

Voriconazole

MEDICINE NAME:

Voriconazole

TRADE NAME(S):

Vfend®

PRESENTATION OF MEDICINE:

Vial containing 200mg voriconazole powder for reconstitution.⁽¹⁾⁽⁵⁾

METHOD OF ADMINISTRATION:

ADULTS plus adolescents 12-14 years and weighing more than 50kg and 15-17 years regardless of body weight

Administer a loading dose of 6mg/kg every 12 hours (for the first 24 hours) by IV infusion at a rate of not more than 3mg/kg/hour over 1-3 hours. Follow with a maintenance dose infusion of 4mg/kg every 12 hours at a rate of not more than 3mg/kg/hour over 1-3 hours.⁽¹⁾

CHILDREN (2 to less than 12 years and young adolescents 12 to 14 years and less than 50kg)

Administer a loading dose of 9mg/kg every 12 hours (for the first 24 hours) by IV infusion at a rate of not more than 3mg/kg/hour over 1-3 hours. Follow with a maintenance dose infusion of 8mg/kg every 12 hours at a rate of not more than 3mg/kg/hour over 1-3 hours.⁽¹⁾

INSTRUCTIONS FOR RECONSTITUTION:

Add 19mL of water for injections to the contents of the vial to obtain a 10mg in 1mL solution and shake the vial until the solution is clear. Requires further dilution before administration.⁽¹⁾⁽³⁾⁽⁴⁾⁽⁵⁾

Discard the opened vial if the vacuum does not pull the diluent into the vial.⁽¹⁾⁽⁴⁾

DISPLACEMENT VALUE:

1mL⁽¹⁾⁽³⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Add appropriate volume of 10mg/mL reconstituted voriconazole solution to suitable diluent to give a final concentration of 0.5-5mg/mL voriconazole.⁽¹⁾⁽³⁾⁽⁴⁾⁽⁵⁾

Suitable diluents are sodium chloride 0.9% or glucose 5%⁽¹⁾⁽⁴⁾⁽⁵⁾

STABILITY:

Use immediately after reconstitution. .⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%⁽¹⁾⁽⁵⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Infusion related reactions, predominantly flushing and nausea have been observed during administration. Other commonly reported adverse effects include visual disturbances, peripheral oedema, rash, pyrexia and headache. Depending on the severity of symptoms,

consideration should be given to stopping treatment.⁽¹⁾

Anaphylactoid reactions occurring immediately upon initiation of the infusion have also been reported. The symptoms include flushing, fever, sweating, tachycardia, chest tightness, dyspnoea, faintness, nausea, pruritus and rash.⁽¹⁾⁽²⁾⁽⁵⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or intravenous products. Electrolyte disturbances such as hypokalaemia, hypomagnesaemia and hypocalcaemia should be corrected prior to initiation of voriconazole therapy. Voriconazole must not be administered simultaneously with any blood product or any short term infusion of concentrated solutions of electrolytes, even if the two infusions are running in separate lines.⁽¹⁾⁽³⁾

Parenteral nutrition (PN) need not be discontinued when prescribed with Vfend®, but does need to be infused through a separate infusion set or cannula.⁽¹⁾⁽³⁾

SPECIAL HANDLING PRECAUTIONS:

Eye contact: Immediately flush eyes with water for at least 15 minutes. If irritation persists, get medical attention.⁽⁸⁾

Skin contact: Wash with soap and water. Remove contaminated clothing and shoes. If irritation occurs or persists, get medical attention.⁽⁸⁾

SODIUM CONTENT (mmol):

9.62mmol per vial ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Reconstituted solution approximately 507mOsmol/L ⁽⁹⁾

pH:

5.5 to 7.5 ⁽⁹⁾

REFERENCES:

1. Summary of Product Characteristics, Vfend®, last updated 29/02/2012
2. Martindale "The Complete Drug Reference" accessed via www.thomsonhc.com on 20/03/2012
3. American Hospital Formulary Service Drug Information 2011 accessed via www.medicinescomplete.com on 22/02/2012
4. Trissel "Handbook on injectable drugs" 16th Edition pg 1552
5. British National Formulary No. 63, March 2012 pg 396 and 1001
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
 - a) British National Formulary for Children 2011-12 pg 304
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer - January 2007
9. Drug company name: Pfizer Date contacted: March 2012

Version 6 (NHS Lothian local amendment)

Intravenous

Zidovudine

MEDICINE NAME:

Zidovudine

TRADE NAME(S):

Retrovir®

PRESENTATION OF MEDICINE:

Vials containing zidovudine 200mg in 20mL solution (10mg zidovudine/mL) ⁽¹⁾

METHOD OF ADMINISTRATION:

NOT BE ADMINISTERED UNDILUTED, BY IV BOLUS INJECTION OR RAPID INFUSION

IV infusion: Administer the required dose of the diluted product over 60 minutes. ⁽¹⁾⁽³⁾⁽⁴⁾⁽⁵⁾

During labour and delivery, administer 2mg/kg bodyweight, over 60 minutes, using an infusion pump followed by a continuous intravenous infusion at 1mg/kg/hour until the umbilical cord is clamped. ⁽¹⁾⁽³⁾⁽⁹⁾

In neonates, administer 1.5mg/kg bodyweight, using an infusion pump, over 30 minutes. ⁽¹⁾⁽³⁾⁽⁹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT:

Dilute with glucose 5% to a concentration of 2mg per mL or 4mg per mL. ⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾⁽⁵⁾

Must be diluted before use. ⁽¹⁾⁽³⁾

EXPIRY TIME TO WRITE ON THE CONTINUOUS INFUSION (PREPARED IN A CLINICAL AREA) 'MEDICINE ADDED' LABEL:

24 hours. However, should any visible turbidity appear in the product either before or after dilution or during infusion, the preparation should be discarded. ⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9% , glucose 5% ⁽¹⁾⁽³⁾⁽⁴⁾⁽⁵⁾⁽⁹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

May cause pain, irritation and phlebitis at injection site. ⁽¹⁰⁾

EXTRAVASATION:

Zidovudine 10mg/ml when diluted to a concentration of 2mg per mL or 4mg per mL is not an irritant or a vesicant.

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

In the absence of compatibility studies, zidovudine must not be mixed with other medicinal products. ⁽¹⁾

Medicines can meet close to the vascular access device or in a line (Y site compatibility).

In these cases zidovudine infusion is **compatible** with: aciclovir sodium, allopurinol sodium, ceftazidime, ceftriaxone, cimetidine, clindamycin, dexamethasone, dobutamine, dopamine, erythromycin, fluconazole, gentamicin, heparin, morphine, remifentanyl. ⁽⁴⁾

Zidovudine infusion is **incompatible** with meropenem. ⁽⁴⁾

SPECIAL HANDLING PRECAUTIONS:

None ⁽⁸⁾

SODIUM CONTENT (mmol):

None ⁽⁹⁾

OSMOLARITY / OSMOLALITY:

Zidovudine 10mg in 1mL: 34mOsmol/L (10mg/mL)⁽⁹⁾

pH:

Approximate pH 5.5 ⁽¹⁾⁽⁴⁾⁽⁹⁾

OTHER COMMENTS:

Store vials below 30°C and protect them from light. ⁽¹⁾⁽³⁾

REFERENCES:

1. Summary of Product Characteristics, Retrovir 10mg/mL IV for infusion, last revised 1 Dec 2008
2. Martindale accessed via <http://www.medicinescomplete.com> on 26 Jan 2010
3. American Hospital Formulary Service Drug Information 2007, accessed via <http://www.medicinescomplete.com> on 26 Jan 2010
4. Trissel "Handbook on injectable drugs" 15th Edition
5. British National Formulary No. 58, September 2009 (online version)
6. Royal College of Paediatrics and Child Health "Medicines for Children" 2003
a) British National Formulary for Children 2009
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines - December 2011](#)
8. COSHH report compiled by manufacturer
9. Drug company name: Glaxo SmithKline
Date contacted: Jan 2010
10. www.extravasation.org.uk accessed on 26 Jan 2010

Version 4

Intravenous

Zoledronic acid 5mg

Caution: Do not confuse with zoledronic acid 4mg in 5mL concentrate for infusion and 4mg in 100mL intravenous infusion (Zometa® and generics) which are licensed for a different indication.

MEDICINE NAME:

Zoledronic acid

TRADE NAME(S):

Aclasta®

PRESENTATION OF MEDICINE:

Plastic bottles containing zoledronic acid 5mg in 100mL (as monohydrate). Solution for intravenous infusion.⁽¹⁾

METHOD OF ADMINISTRATION (adult):

IV Infusion: Infuse at a constant rate over a minimum of 15 minutes via a vented infusion line.⁽¹⁾ Patients must be appropriately hydrated prior to administration. This particularly refers to elderly patients and those receiving diuretic therapy.⁽¹⁾

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

Aclasta® is available as a 5mg in 100mL ready-to-infuse solution.⁽¹⁾

FLUSHING:

Flush with sodium chloride 0.9%.⁽⁹⁾

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

1. Fever and flu-like syndrome including asthenia, pain, malaise.⁽¹⁾
2. Bone pain, rigors, arthralgia, myalgia and headache.⁽¹⁾
3. Local reactions at the infusion site such as swelling, redness, irritation, skin thickening and pain.⁽¹⁾⁽⁹⁾
4. Nausea, vomiting and diarrhoea.⁽¹⁾

Monitoring:

Measure creatinine clearance before each Aclasta® dose. Aclasta® is contraindicated in patients with creatinine clearance less than 35mL/minute.⁽¹⁾⁽¹²⁾

Monitoring of serum creatinine should be considered in patients at risk of renal impairment.⁽¹⁾⁽¹²⁾

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicine or infusion.⁽¹⁾

Incompatible: Calcium containing solutions⁽¹⁾ e.g. Ringers solution, calcium chloride injection, sodium lactate, compound (Hartmann's).

SODIUM CONTENT (mmol):

Negligible.⁽⁹⁾

OSMOLARITY / OSMOLALITY:

300mOsm/kg (range +/- 20%).⁽⁹⁾

pH:

6.4 to 6.6.⁽⁹⁾

OTHER COMMENTS:

1. The incidence of adverse reactions occurring in first 3 days can be reduced by administering paracetamol or ibuprofen shortly after the infusion, as needed.⁽¹⁾
2. Patients with Paget's disease, it is strongly advised that adequate supplemental calcium corresponding to at least 500mg of elemental calcium twice daily with vitamin D is ensured for at least 10 days following zoledronic acid administration, to reduce the chance of transient hypocalcaemia.⁽¹⁾
3. To date, clinical trial results have suggested an increased risk of atrial fibrillation for zoledronic acid (Aclasta®). The risk of atrial fibrillation in association with bisphosphonate treatment seems to be low, and the balance of risks and benefits for bisphosphonates remains favourable.⁽¹⁾
4. Excipients: mannitol, sodium citrate, water for injections.⁽¹⁾

REFERENCES:

1. Summary of Product Characteristics, Aclasta®, last revised 04/05/2012
2. Martindale the "Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 09/07/2013
3. American Hospital Formulary Services Drug Information accessed via <http://www.medicinescomplete.com> on 09/17/2013
4. Trissel "Handbook on injectable drugs" 15th Edition accessed via <http://www.medicinescomplete.com> on 09/07/2013. No relevant information
5. British National Formulary No. 65 accessed via www.bnf.org/bnf on 09/07/2013
6. British National Formulary for Children 2012-2013. No relevant information
7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
8. COSHH report compiled by the manufacturer. Date of issue 06/04/2013
9. Drug company: Novartis
Date contacted: 12/07/2013
10. National Extravasation Service accessed via www.extravasation.org.uk on 10/07/2013. No relevant information
11. Bisphosphonates: atrial fibrillation, July 2008 accessed via www.mhra.gov.uk/Safetyinformation/DrugSafetyUpdate/con085167
12. on 09/07/2013
13. Updated Safety Information Reports of Renal Impairment with Aclasta® (zoledronic acid, 5mg solution for infusion), March 2010 accessed via www.mhra.gov.uk/home/groups/pl-p/documents/websiteresources/con076456.pdf on 09/07/2013

Intravenous

Zoledronic acid 4mg

Caution: Do not confuse with Aclasta® (zoledronic acid 5mg in 100mL solution for infusion) which is licensed for a different indication

MEDICINE NAME:

Zoledronic acid

TRADE NAME(S):

Zometa®
Zoledronic acid (Actavis; Hospira; medac GmbH; Sandoz)

PRESENTATION OF MEDICINE:

Products which require dilution before use:

[Novartis; Sandoz; Actavis; Medac GmbH]: Plastic vials containing zoledronic acid 4mg in 5mL (as monohydrate). Concentrate for solution for intravenous infusion.^(1a-d)

Ready-to-use product:

[Novartis; Sandoz]: Plastic bottles containing zoledronic acid 4mg in 100mL for intravenous infusion.^{(1e)(1h)}

[medac GmbH]: Colourless glass bottles containing zoledronic acid 4mg in 100mL solution for intravenous infusion (as monohydrate).^(1g)

[Hospira]: Plastic bags containing zoledronic acid 4mg in 100mL for intravenous infusion (as monohydrate).^(1f)

METHOD OF ADMINISTRATION (adult):

IV infusion: Give over at least 15 minutes ^(1a-h)

Patients must be well hydrated prior to and after administration.^(1a-h)

INSTRUCTIONS FOR DILUTION AND SUITABLE DILUENT (adult):

Concentrate for intravenous infusion: Preferably use ready-to-use 4mg in 100mL product. If unavailable, dilute the 4mg concentrate product to 100mL with sodium chloride 0.9% or glucose 5%.^(1a-d)

FLUSHING:

Flush with sodium chloride 0.9% or glucose 5%^(1a-h)

ADVERSE EFFECTS WHICH MAY BE CAUSED BY INJECTABLE ADMINISTRATION AND SUGGESTED MONITORING:

Adverse effects:

Flu-like syndrome including fatigue, rigors, malaise and flushing.^(1a-h)

Hypersensitivity reactions, anaphylaxis and angioneurotic oedema.^(1a-h)

Headache, fever, bone pain, myalgia, arthralgia, rigors and generalised pain (including in the extremities).^(1a-h)

Nausea, vomiting and diarrhoea.^(1a-h)

Dizziness and somnolence.^(1a-h)

Severe hypocalcaemia reactions including cardiac arrhythmia, seizures, tetany and numbness.^(1c,1g)

Local reactions at the infusion site such as swelling, redness and pain.⁽⁵⁾

Monitoring:

Monitor serum creatinine, urea and electrolytes, calcium, phosphate and magnesium levels before each dose of zoledronic acid.^(1a-h)

Ensure adequate hydration before and after doses of zoledronic acid as dehydration predisposes to deterioration in renal function.^(1a-h)

COMPATIBILITY INFORMATION USEFUL IN CLINICAL PRACTICE:

Do not infuse with any other medicines or infusions.^(1a-h)

Zoledronic acid (Novartis; Sandoz; Actavis; medac GmbH; Hospira) are incompatible with calcium or other divalent cation-containing solutions e.g. Ringer's solution for injection, sodium lactate intravenous infusion compound (Hartmann's solution).^(1a-h)

SODIUM CONTENT (mmol):

Concentrate: Negligible.^{(1b)(1d)(9a)(9c)(9d)}

Ready-to-use solutions: [Novartis; medac GmbH; Sandoz]: Negligible.^{(1h)(9a)(9c)(9d)}

Ready to use solution: [Hospira] 16mmol.^(9e)

OSMOLARITY / OSMOLALITY:

270 to 300mOsmol/kg^(9a-e)

pH:

Concentrate for infusion: 5.5 to 7.5.^(9a-d)

Pre-diluted solution for infusion: 5.5 to 7.0.^{(9a)(9c-e)}

OTHER COMMENTS:

1. Ensure the patient is well hydrated before and after administration to reduce the risk of renal impairment.^(1a-h)
2. Giving paracetamol following administration may reduce the incidence of acute flu-like syndrome.⁽³⁾
3. Store at room temperature.^(1a-h)
4. Smaller infusion volumes (e.g. 50mL) and rapid over (5 minutes) IV infusion rates (unlicensed) have been associated with an increased risk of renal impairment which may progress to renal failure. Do not exceed the recommended concentrations or infusion rates.⁽³⁾

REFERENCES:

1. Summary of Product Characteristics
Concentrate for solution for infusion
 - a) Zometa® 4mg/5mL concentrate for solution for infusion, Novartis. Last revised 13/06/2013
 - b) Zoledronic acid 4mg/5mL concentrate for solution for infusion, Actavis. Last revised 31/05/2013
 - c) Zoledronic acid 4mg/5mL concentrate for solution for infusion, medac GmbH. Last revised July 2013
 - d) Zoledronic acid 4mg/5mL concentrate for solution for infusion, Sandoz. Last revised

12/06/2013

- e) Zometa® 4mg/100mL solution for infusion. Novartis Last revised 13/06/2013
- f) Zoledronic acid 4mg/100mL solution for infusion, Hospira. Last revised 12/06/2013
- g) Zoledronic acid 4mg/100mL solution for infusion, medac GmbH. Last revised July 2013
- h) Zoledronic acid 4mg/100mL solution for infusion, Sandoz. Last revised 12/06/2013
- 2. Martindale the "Complete Drug Reference" accessed via <http://www.medicinescomplete.com> on 16/07/2013
- 3. American Hospital Formulary Services Drug Information accessed via <http://www.medicinescomplete.com> on 17/07/2013
- 4. Trissel "Handbook on injectable drugs" 15th Edition accessed via <http://www.medicinescomplete.com> on 16/07/2013. Nil relevant
- 5. British National Formulary No. 65, March 2013
- 6. British National Formulary for Children 2012-2013 accessed via <http://www.medicinescomplete.com> on 16/07/2013. Nil relevant.
- 7. Medical Devices Agency device bulletin: [Infusion systems MDA DB2003\(02\) v2 Nov 2010](#)
 - a) [Consensus guide on identification of potential high risk injectable medicines – November 2013 \(updated January 2014\)](#)
- 8. COSHH report compiled by the manufacturer
- 9. a) Drug company name: Novartis Pharmaceuticals UK Ltd. Date contacted: 29/07/2013
 - b) Drug company name: Actavis. Date contacted: 31/01/2013
 - c) Drug company name: medac GmbH. Date contacted: 18/07/2013
 - d) Drug company name: Sandoz Ltd. Date contacted: 26/07/2013
 - e) Drug company name: Hospira UK Ltd. Date contacted: 22/07/2013

Version 4